
EFFICIENCY SYSTEMS AND LABOR.

COMMISSION ON INDUSTRIAL RELATIONS.

WASHINGTON, D. C., Monday, April 13, 1914.
The commission met at 10 o'clock a. m. in the assembly room of the Shoreham Hotel.

Present: Commissioners Frank P. Walsh (chairman), John R. Commons, Mrs. J. Borden Harriman, Frederic A. Delano, Harris Weinstein, S. Thrusdon Ballard, John B. Lennon, James O'Connell, and Austin B. Garretson.
Present also for the commission: Mr. W. O. Thompson, counsel; Mr. W. Jeff Lauck, managing expert; Mr. George E. Barnett, special investigator; Mr. B. M. Bird, superintendent Division of Industrial Investigations; and Mr. F. H. The CHAIRMAN: The commission will please come to order. On the hearing

on efficiency systems and labor I have but one general suggestion to make, and that is that so far as possible the subject be confined to the question of the relations that arise naturally between employers and employees in the application of efficiency systems or scientific management.

I would be glad to have the witnesses who are present kindly take seats on the first-row chairs to the right and attend as far as possible the hearing, so that each witness as he testifies may be heard by the other witnesses.

The first witness on the calendar for to-day is Mr. Frederick W. Taylor, of Philadelphia.

Mr. Thompson, you may proceed with the examination.

TESTIMONY OF MR. FREDERICK W. TAYLOR.

Mr. THOMPSON. Mr. Taylor, will you kindly give us your full name and address?

Mr. TAYLOR. Frederick W. Taylor; Chestnut Hill, Philadelphia.

Mr. THOMPSON. What is your business, Mr. Taylor?

Mr. TAYLOR. Consulting engineer. I, however, have given up all work for money, for pay. For the past 12 years all the work I have been doing has been done not for pay, but, if I may say, in the interest of scientific management, trying to further the cause of scientific management.

Mr. THOMPSON. You may state briefly, if you will, what your experience was before that, and then a little more fully as to what you are doing in carrying out this work for which you receive no compensation.

Mr. TAYLOR. I received my preliminary education in Germantown, where I was born, near Philadelphia, and went abroad for three and one-half years, and was at school in Paris and Berlin and Stuttgart and Italy, and returned eyes broke down and I was obliged to work for seven years as an apprentice; I served two apprenticeships, and then went to the Midvale Steel Works as a laborer, because I could not get employment as a mechanic, and went up through the Midvale Steel Works until I became chief engineer and manager of the works. Then I left the steel works, because I believed there was a larger field of usefulness in introducing the principles of scientific management into other establishments.

From that time until I retired in 1901, I was engaged in systematizing and introducing the principles of scientific management into various industrial establishments. Since that time I have been attempting to help a good many of my friends to introduce the principles of scientific management in industrial establishments, helping them by teaching them, and by so far as is possible, giving men the opportunity to work in establishments which are introducing scientific management. That has been my work since then.

Mr. THOMPSON. Do you maintain an office and a force?

Mr. TAYLOR. I have an office with a private secretary, but I have no money-making establishment of any sort, and no affiliation or connection with any money-making affair of any kind.

Mr. THOMPSON. Do you educate other people in your system, or do they educate themselves by reading your books?

Mr. TAYLOR. For a good many years past there have been quite a number of men who were very competent, men who showed ability in this direction, whom I have been teaching and helping to learn scientific management. My part consists largely in securing the opportunity for them to work in various establishments, and where they can not afford to do without the salary I have paid the salary of quite a number of them for several years while they are learning the introduction of scientific management. I may say that every cent of my surplus income, and a little more, for a good many years has gone into the cause of scientific management.

Mr. THOMPSON. Then your work in that matter is really a work of social welfare and advancement?

Mr. TAYLOR. Well, I am asked continually to contribute to charities of various sorts and my universal answer is that I do not conceive there is any charity to which I could devote my money that would compare in any way with the good that is done by scientific management. My reason for that is that as many as a thousand or two thousand men annually come under the principles of scientific management, who automatically receive an increase of from 20 to 100 per cent in wages, and who become the best friends that their employers can have. That is to say, instead of being enemies of their employers, they become their warm, firm friends, and they enter upon careers of prosperity and development such as they never have had an opportunity to have before. That is largely brought about by the effort of men who are capable of going into the old type of establishments and guiding and directing them during the change from the older to the newer type. So I feel that every cent and every minute that I can put into that, while it may not be a charity, is certainly accomplishing more for my friends, the workmen, than anything else I could do. And I want to make it perfectly clear, because I do not think it is clear, that my interest, and I think the interest of every man who is in any way engaged in scientific management, in the introduction of the principles of scientific management, must be first the welfare of the workmen. That must be the object. It is inconceivable that a man should devote his time and his life to this sort of thing for the sake of making money for a whole lot of manufacturers. Incidentally it is impossible—anyone who has any sense and who has lived in the world knows that it is impossible—to do the one without doing the other. You must make their interests mutual. And I may say that I would not devote 5 minutes of my time to this if it were not for the workmen. What I am working for is for this increase in prosperity and happiness and wages, and particularly in the friendliness of the working people toward their employers. That is my chief work.

Mr. THOMPSON. You have been invited to come here and present your ideas in the form of testimony with reference to efficiency systems and labor, teaching men how to work in the carrying out of efficiency systems. What have you to say on that subject?

Mr. TAYLOR. I have a great deal to say if the commission would like to listen. The Chairman. That is good. You may proceed.

Mr. TAYLOR. I would suggest that if I may be allowed to do so I be given time to set forth the general principles of our system and its relation to the workmen without answering any questions until the subject is rounded out. If the gentlemen will kindly make notes of questions they would like to ask, they will find that 9 out of 10 of them will answer themselves automatically. So it will save a lot of questioning if you will write down the questions and ask them all at the end. I do not want to dodge questioning. I welcome it, and I would rather have the questions than to say what I am going to say, but in order to eliminate a very large number of questions, I would suggest that I be allowed to talk without interruption until I have told the story, so to speak.

The Chairman. Very well. You may proceed in that way.

Mr. TAYLOR. I am going to talk about workmen, to generalize about workmen, and I hope I can make myself clear at the start that in what I say of workmen I have in mind only that limited class of workmen who are engaged in what may be called coordinated industries, not the workmen who are engaged in isolated work; because it is very important to make that dis-

inction. The generalizations which apply to that class of men do not apply to the isolated worker. They do not apply to the engineer, the coachman, or to the man who is doing work for his own account. So I am going to generalize about workmen a good deal; and, again, let me say that in talking as briefly as I am about to talk, I have to state broad truths which, of course, are subject to a vast number of exceptions. I do not mean to be dogmatic and to neglect those exceptions, but I do mean, in what I have to state, to state broad truths, please bear that in mind, because otherwise what I am going to say will sound ridiculous and, in some cases, preposterous, because there are so many exceptions to the rules.

As I conceive it the most serious fact that faces the industrial world to-day—not only in this country, but all over the industrial world—is the broad fact that the average workman believes it is for his interests on the whole to go slow, to curtail the output rather than to turn out as much work as he can each day. Workmen throughout the civilized world are firmly convinced that it is for their interest to go slow instead of going fast. That is, I conceive, the saddest, the most unfortunate fact in industry to-day. There are two great causes for that in the minds of the workmen. The first is, that if you will take any trade, I do not care what it is, and suggest to any set of workmen in the trade that it would be a good thing for them to double their output in that trade, they will say right away, "I do not know anything about other people's trades, but I do know that in my own trade there can be but one result from doubling the output—that is, that half of us would be thrown out of a job inside of a couple of years." That is all that would happen in our trade." That fact is so self-evident to the average workman that it does not admit of an argument and you can not reason with him about it. He says, "My dear boy, I do not know anything about other trades, but in my trade half of us would be out of a job if we were to double our output." That settles the whole question as far as that man is concerned. You can not argue with him.

Not only that, but I find that doctrine is very largely believed in by my friends—the leaders of the labor unions. They are firmly convinced that that is true. I find not only that, but that a great majority of men who are well read with relation to industrial matters, and well read with relation to the history of industry, will say the same thing and will reach the same conclusions. They will say it is almost an axiomatic fact, where that has happened. I have never yet been able to find out a single instance where, if any of you have found it, I wish you would point it out. I have yet to find a single instance in which exactly the opposite has not been true. In every instance the introduction of labor-saving machinery—never was formerly turned out, never mind what has come in which has increased the output—I would be glad to have anyone point out a single case in which that trade. It has never thrown men out of work except temporarily—right in the first three or four months, perhaps. The effect has invariably been to make work for more men in that particular trade in every case. I have never yet had a case pointed out in which that was not true. I am looking for a case, and I am hoping that some one will point out such a case.

That sounds like an extraordinary fact. How can the introduction of labor-saving machinery keep on making work for more men in every trade? There is one trade in which that is not true, if you choose to call it a trade, or one occupation, and that is the occupation of farming.

One hundred years ago it took 80 per cent of the world's workers to feed the world. To-day it takes 36 per cent of the world's workers to feed the world. It is from this great farming population that the men are coming to do the trades, and the more you introduce labor-saving machinery, the more you do in the direction of increasing it. The more men that come from the farms to the industries—the more men devote themselves to that side of the work. That is the history of industry, and it is a very significant fact. It is such a vital fact that I think that every man who has a knowledge of the matter, who has any interest in the working people of the world, ought to realize that when any device comes along which makes for the increase of efficiency, it enables the same number of workmen to turn out a larger amount of work, and that instead of injuring the workmen or throwing them out of work, it is on the way to create more work for the men in that

trade. That is the universal history of industry. But there ought to be at least one illustration, because, after all, my say so amounts to nothing. Let us have one illustration of this fact, because, after all, illustrations are what count, and not somebody's notions, theories, talks, or generalizations.

Take the cotton industry, for instance. In 1840, or thereabouts, broadly speaking, 1840, the power loom superseded the old hand loom. The power loom was invented 50 years before, but at that time inventions were very slow in being introduced. About 1840 it came into Manchester, England. There were at that time in Manchester 5,000 weavers, and those men knew what the loom was going to do, that it would turn out three times the work that they had been turning out in the past, and they knew that after the power loom was introduced, instead of there being 5,000 weavers in Manchester there would be only 1,500 of them left. Gentlemen, realize that at that time the immobility of labor was something appalling. A man was born in the trade, and lived in a town, and never moved out of that town until he died. That was the rule. You will remember the laws that were made only a little time before that prohibiting the migration of workmen from one county to another in England, so that labor was exceedingly immobile; and these weavers, when they saw this power loom coming, saw themselves and their families facing starvation. Put yourselves in their place. Before we judge harshly of any set of men, we should put ourselves in their environment. I am not defending arson or murder, or anything of that sort, but I want you gentlemen to put yourselves in their places before you judge these poor fellows too harshly. What they did was to break into the establishments in which the power loom was coming, to smash the looms and to burn the establishments, and to beat up the scab, and to do everything possible to stop the introduction of that power loom. I do not blame them. You and I would have done the same thing, or if not the same thing, then the same thing in kind, for broadly speaking, we would have fought for our lives and families; so that I want you gentlemen not to condemn these people too severely. It was in kind what you and I would have done.

What was the effect of their fight against the introduction of the new labor-saving machinery? Just what it always has been, just what it always will be. It was nothing. The power loom came right along. I am not sure its introduction was not accelerated by the fight. I am sure that in many cases opposition to the introduction of labor-saving machinery accelerates its introduction. I am sure that the opposition to the introduction of scientific management has accelerated its introduction, and not retarded it in the least. It has gone on far more rapidly since the opposition became more acute than before, and it will be so.

If scientific management is designed for increasing the efficiency of men without materially increasing their effort and without overworking men, then, mark my words, any opposition, from whatever source, however powerful and whatever it is, will merely increase the rapidity of its introduction. That is the history of industry.

I predict the same thing for scientific management. If what I say is true, and if it is not true, it is going to fail, and ought to fail. That is the history of industry.

The power loom came. Let us see what happened. Less than 100 years have gone by. The population of England in that time has certainly not more than doubled, and for every man engaged in the cotton industry in Manchester now there are 10 yards of cloth produced to 1 yard that was produced before the introduction of the power loom, which is before this fight in 1840. Ten yards are coming out now, to every man in the industry, for one that was turned out before 1840. There were 5,000 weavers in Manchester, England, in 1840. There are now 265,000. Has that thrown men out of work? Has the introduction of labor-saving machinery thrown men out of work? Two hundred and sixty-five thousand men are working there now where there were 5,000 in 1840, and each of those 265,000 men is turning out at the very least 10 times the yardage of cloth turned out in 1840. Multiply that, and you will find that for every yard that went out in 1840 there are at least 500 yards of cotton that go out to-day, and that is the history of industry. That is an illustration of why the world is making progress. That is an illustration of why the workmen of to-day live so much better than they did some time ago. I have got lots of them who are my friends, I have lots of them into whose homes I go, the families of mechanics, and I know that they live

better than kings did 250 years ago. They have more luxuries, and more that is fine in life, than kings did 250 years ago. What is it due to—this increase of output? All of that goes to luxury, leisure, art, culture, because of this increase in output. That is the source of it. It gives them the opportunity for it.

What is the fundamental meaning of this? There is something back of this output in cotton. What does it mean? It means two things that all you have to do in this world is to bring true riches into the world, and the world uses them. That is the fundamental meaning. All you have to do is to create riches and bring them into this world, and the world uses them. Think of it, 500 yards of cotton cloth now being manufactured and turned out at Manchester, England, to every 1 in 1840! We do not think of the fact that in 1840 cotton goods were a luxury, to be used only by the rich people, that the poor people wore ragged woollen goods. What possibly has become an everyday necessity, an absolute thing of necessity to all of us, at that time was the greatest kind of a luxury; and that is what is going on all over the world. That is what is going on in every industry throughout the world—this change from rank luxury in one generation to what becomes absolute necessity in the next; and I am looking forward, through this same increase in output, to the fact that 100 years from now the working people are going to be living just as well as merchants live now, just as happily; and what is it coming from? This increase in output, and nothing else. I am dwelling on that, because, after all, the greatest source of opposition to the introduction of scientific management is because the working people are afraid of throwing people out of work. They are afraid that through scientific management people will be thrown out of work. That is the greatest reason for the main opposition to scientific management.

I want to call attention now to one thing, and that is that the working people are in no way to blame for this opposition. I want to know who is bringing these facts to the attention of the working people of this country? You gentlemen live in various cities. What man in your city has talked to them and told the working people what I have been telling you now? On the contrary, their leaders, honest men, straightforward men, but simply badly educated men, men who have not looked into their own trades, are telling them the opposite thing and they are suggesting the strictest legislation in almost every trade-union, in the interest of the trade, for fear some one will be thrown out of a job, in order to maintain the prices, and for various reasons. There is hardly a trade in which there has not been restrictive legislation enacted, in which there has not been suggestion of it. Who is telling to the working people what I have said to you now? I do not know who it is. Who is pointing these facts out to them? Gentlemen, if you would go to England and if you would look at the condition there you would find that it is something frightful. I am heartily in favor of a redistribution of wealth, to a certain extent. I believe, to a certain extent, there is too much wealth in certain hands and too little in other hands. I am heartily in favor of that, but when it comes to the socialistic legislation that is going on in England, it is doing nothing. It is doing nothing; it is putting a little bit of a plaster on the outside. The great fundamental fact in England is that every workman in England is born to the fact that he must curtail the output if he is going to do his duty to himself and his kind.

What do you think of it? Just think of it! I have a magazine published last August containing an article by Ellis Barker, one of the greatest statisticians of England, in which he gives 30 American trades and English trades in which the output of the average American workman is shown to be more than three times that of the English workman. The English workman are just as good as our workmen are. I have run up against them and I know they are just as good as our men. But they have that restriction of output; the unions have had such control for such a length of time there—but in an absolutely misguided way and absolutely through misunderstanding—that they have restricted the output to such an extent that those poor fellows over there turn out only one-third of what our men are able to turn out. How can they get wages—not so much wages, but how can they get food, the luxuries of life, and even the ordinary necessities of life when they are only turning out one-third of the output?

Wealth comes into the world from no other source. It is what these men produce that constitutes the wealth of the world, and no amount of juggling, no amount of legislation, no amount of anything else, will ever give that wealth to the people unless these men produce it. You have to bring it into the

world and give it to them, and yet they are refusing to bring it into the world. They are robbing their own kind, because nineteen-twentieths of the wealth of the world is consumed by the rich. All the poorer people are suffering, and they will as long as they fail to get these good things, and it will not be the rich people who will suffer. That is what the poverty of England is due to to-day, and that is what Barker points out. I have known isolated facts, in every industry I have looked into myself I have found that in comparison with England we are producing three times as much, and I went further than Ellis Barker and have looked into many instances, and have gone into the work-rooms of these people, and these poor fellows are deliberately soldiering, deliberately restricting output and doing it conscientiously because they believe it is for the good of their kind. There is nothing dishonest about it as they see it. It is merely a bad instruction, merely that they do not know what they ought to be doing for their own interests. They have never been properly educated.

What is the end of this? It is horrible when you think of it. What is the ultimate effect of this restriction of output? It means the people in England who have passed 65 years of age are living on less than \$2.50 a week. That is the outcome of it all. Two-thirds of the people who are past 65 years of age are living on less than \$2.50 a week. That is due to restriction of output, and you may legislate all you please for redistribution of wealth; but until in England they climb up and do a proper day's work and do what they should do by turning the entire thing over, they will never get wealth, they will never get the luxuries, and they will not even get the necessities.

What I want again to emphasize is that the working people are not to blame for this.

The second cause is this: If you are making a pen like this [indicating], let us consider what the situation is. Let us assume that a pen like that can be made by a single man. It can not, of course, but let us simply assume that one man can make a pen like that. He is making 10 pens a day and getting \$2.50. If he has any kind of a foreman, that foreman is the sort of a man who sympathizes with his men and wants them to prosper and he will say to this workman, "You are making 10 pens a day; you are getting \$2.50 a day. Why not make them by the piece?" The man will say, "That is first rate; I will be delighted to do it." At the end of the year, the workman, through his own exertions and the help of his foreman and friends who have been around him, through his own ingenuity and through the incentive that is offered him, finds himself turning out 20 pens instead of 10. That is a very common and usual thing, not at all unusual. The workman is delighted, because he is getting \$5 a day where before he got \$2.50 a day. The workman is pleased, because he has doubled his income. The foreman is pleased because he has doubled the output of his shop with the same number of men.

Everybody is pleased except some member of the board of directors. I have been a member of boards of directors, and I imagine that some of you have likewise been members of boards of directors. We must not condemn this man, because he thinks it is his duty to do it, but some member of the board of directors calls for the pay roll, and to his horror he finds that a lot of his workmen are getting \$5 a day, whereas the ruling rate of wages for workmen of that kind in that community is \$2.50. I have seen that over and over again. It is a shock to that man. It is a genuine question with him: from his viewpoint, we are ruining the labor market in our part of the country. He will say that Washington can not compete with other places because we are paying \$5 a day and the rest of the country paying \$2.50 a day. It is perfectly self-evident to that man, or he thinks it is. It is a fallacy, but he thinks he is right. He sends for that foreman and wants to know the reason why those men are paid \$5 a day where similar men in a similar occupation in other parts of the country are paid \$2.50, and he is told he must stop ruining the labor market of Washington. That foreman, with sadness—if he is any kind of a man, and in nine cases out of ten he is—is utterly distressed, but is obliged to reduce the men's piecework prices until he finds himself turning out 20 pens a day and only getting \$2.75, if he is liberal, or \$3 a day, where he only got \$2.50 before. That is what takes place all over the country under the piecework system; that is the piecework system. Those of you who have worked under it know it. Those of you who have been bosses know it. That is the system of the world in piecework. I am not blaming the people, because there was not for a long time any other system or any better system than that. There was no alternative. That was all they could do.

Just let me tell you one thing: There are a great many people who question the honesty of the workmen, who debate whether they are not deteriorating in this country, etc. Whatever your views as to the honesty or dishonesty of the workmen, my personal experience with them has been that they are just as straight, just as praiseworthy as any other class in the community—not more so; not less so. I have been among them and have worked with them for many years, and I have as many friends among them as I have in any other class. That is my personal experience, and whatever your opinion be on that point, whatever your views may be, just put one thing right down: Whatever the workmen of this country are or are not, they are not damned fools. That is straight. They may be a lot of other things, but that they are not. It just takes one cut like this—just one—to make them soldier for life. Who can blame them? They start deliberately and soldier for life, and it becomes a set habit with them. I did not even have to have it before I started to soldiering. I never got my cut. I was too keen. The boys informed me beforehand, when I was an apprentice. When I came into the work I began soldiering without being cut and without being told. We were all intelligent boys; we were all good boys. I do not know that I got a cut all the time I was working. I was very careful. I watched that clock with a very great deal of care, and if I could have turned out 20 times the work I was doing, and if that was the basis, I watched that just as everybody else watches it—and you can not blame them. I was wrong. It would have paid me and the other people much better to have taken our cut and gone right ahead. It is a good deal to ask of a human, however—to ask anyone to accept that cut and smile over it and think it is a good thing for you.

The working people are not to be blamed for that, nor are the employers to be blamed. Hundreds of employers who have to do that deplore it. Their foremen deplore it and their superintendents deplore it. Everyone who is cutting these wages deplores it. It is a sad fact in industry. It is not something that anyone is proud of. I have yet to hear the first man who is proud of it on either side. But there is no better way than that.

What I want to emphasize is this: I want to call your attention to this, because this is perhaps the most important, or one of the most important, facts connected with scientific management. I want to emphasize the fact that the very first step that was taken toward establishing that state of principles which have come to be known as scientific management was taken in an earnest endeavor to correct this evil of soldiering. That is what led to the first move toward the introduction of the principles that have come to be known as scientific management. Gentlemen, every subsequent step that is taken in the introduction of these principles was taken in exactly the same way—not as a theory which someone propounded; not that someone said, "Here is a new idea or scheme or plan," or whatever it might be that might be a good thing to try; not at all—but because there was a crying evil existing in the whole system, palpable and present, and because as the endeavor was made to correct that evil and to correct that existing evil, so that at every step scientific management has been an evolution and not a theory. I want to emphasize that, because every man who has had much experience in this world must be profoundly suspicious of every new theory, and I do not care what that theory is—his own as well as everyone else's—he must be profoundly suspicious of it.

For my own part, whenever I have a new theory, whenever I evolve a new theory, and it has not been tried out and tried out and tried out, whenever I have made a new invention—and I have taken out probably 100 patents—when ever I take out a new patent or develop a new invention of any kind, I say to myself in the enthusiasm of the moment, "By George, that is the finest thing that ever happened; that is a remarkable invention, and it has got to be patented right away." So I proceed to patent it. After the enthusiasm subsides a little bit, then I say to myself, "Friedly, my boy, doubtless this is the most remarkable thing that ever happened in industry, particularly in this branch of industry, but probably the fact is, dear boy, that it is just like the other ninety and nine; it is not worth a damn." That is what I have to say about my own theory and what I say about the new theory of everyone else that comes along. I do not want anyone to confuse scientific management with the new set of theories that are being formed. No one ever reasoned out the theories of scientific management until it had been in use for probably 20 years; no one ever thought that there was a new set of principles. It came as a development of one thing after another, and gradually a set of principles grew up which differed radically from the older principles. No one took pains to analyze those

principles and get to the bottom of them until after they had been in use for 18 or 20 years. Then we began thinking—to analyze them. We said to ourselves, "Here a new thing has taken place. What is this?" I want to emphasize, that it is an evolution and not a theory.

Scientific management exists in a very large number and variety of establishments, and it is safe to say that in the average establishment where scientific management exists the workmen are turning out twice as much work per man as they were before. That is in the average establishment. In many, of course, they are turning out much more than that, and in some few, less than that, but in the average establishment men are turning out about twice as much work. The output of the establishment men has been doubled. That has resulted in an increase in profits and the companies have profited by it. It has resulted in many cases in lowering the selling price, so that the general public has gotten something out of it. But, gentlemen, let me tell you that in the end neither the working people nor the manufacturers are going to get much out of it, that is, a hundred years from now. The general public is going to have it all. The whole world will have it. That is the history of industry. For a while the manufacturer has gotten the most out of it. Then comes along the workman in that industry, and he gets some of it, but very soon the whole general public gets it all, practically speaking. That is the history of industry.

Let me, however, digress here and point out one fact which has not been generally appreciated, and which ought to go to the credit of scientific management; a very important fact, that this is the first instance in the history of industry in which the introduction of labor-saving devices has been done by men who have insisted from the start that the workmen should at once get their share. The men who have introduced scientific management have insisted that the workmen should get an increase in wages. In the introduction of labor-saving machinery formerly the manufacturer has got it all, at the expense of the workman. Every man who comes under scientific management gets automatically an increase of from 33 per cent to 100 per cent in wages at once. This is the first case in industrial history in which that has been true, so far as I know.

There may have been isolated cases that I do not know of, but certainly there has been no general movement. Certainly that has not been characteristic of the introduction of labor-saving machinery, as you all know. In many cases the first effect of the introduction of labor-saving machinery was perhaps to lower wages, because a cheaper type of man was able to run the machine, in some cases. Of course, in the end the whole world profited by it. But in justice to scientific management I want to emphasize the statement which I have just made, that from the start the people who have introduced it have insisted that the workmen should at once get an increase in wages. The owners of the business have a larger profit, the general public shares in the profit, but without any question the workmen have gotten the greatest food that has come under scientific management. There is not the slightest shadow of doubt about that. As I said before, the very moment that workmen come under scientific management, where a man goes from an establishment right next door into one of our establishments, he gets an increase of from 33 to 100 per cent in wages, depending on the character of his work, and that happens right away. That is worth while; and yet without any hesitation I say it is not the greatest gain that comes to workmen under scientific management. The greatest gain that comes to them comes from the fact that they come to look upon their employers as the best friends they have in the world. That is the greatest gain that comes to them under scientific management. Under the old type of management there is suspicion, watchfulness, and a guarding of their own interests is absolutely necessary. They look upon their employer as perhaps a pretty good fellow, but they say, "You have got to watch him; he is human and likely to grab for more than his share." But under scientific management this suspicious watchfulness entirely ceases, and workmen come to look upon their employers as genuinely the best friends they have in the world. That, of course, sounds like a broad statement and very difficult to substantiate, but let me give you some proofs.

In the 30 years in which scientific management has been introduced, there have never been a strike of men working under scientific management. There have been a few strikes of men who were coming under it, but there has never been a strike after the new system has been introduced, after men have come to work under the principles of scientific management. While they were

in process of coming in there have been a few strikes, but only a few, and never a case of a strike where men were working under scientific management; and you can not have a strike. Why is that true? Because the essence of the matter is friendship. Scientific management can not exist without friendship being its characteristic. There is no possibility of it. The moment you have enemy scientific management evaporates into the air and there is no such thing.

What is scientific management? I want to sweep the field clear first by pointing out what it is not. First, I will point out a lot of things which scientific management is not, because I find there is a very great misunderstanding as to what it is.

Scientific management is not any efficiency device, nor is it any group of efficiency devices. It is no part of the mechanism, nor any part of the schemes which are ordinarily looked upon as scientific management.

Scientific management is not any new pay system, it is not any new scheme for paying men. It is not a piecework system.

Scientific management is not time study. It is not functional or divided foremanship. It is not any new cost system. It is not the printing and loading of a ton or two of blanks of printed matter, and saying "There is your system; go ahead and use it." It is none of those things.

I am not sneering at a new pay system, or at a bonus system or a piecework system. They are useful. Some of them have been developed under scientific management, as some of the elements of scientific management. But they do not consist of scientific management. Your whole system is new. Scientific management can not exist, and does not exist, until there has been a complete and entire mental revolution on the part of the workmen as to their duties toward themselves and toward their employers, and an equally great mental revolution on the part of employers toward their duties to their workmen. Until this great mental change takes place I say there can be no such thing as scientific management. That is an absolute necessity. You may have all the mechanism, all the forms of it, you may have your bonus system and your time study, but you have not got scientific management until that change has taken place.

Now, I want to point out just one illustration of this. I do not want to leave that there, because this general talk is so cheap—any one can do it. I do not want to leave you without some illustration of what I mean by this mental change that takes place on both sides. Again taking the illustration of this pen, if you are manufacturing this pen, there is a certain amount of material that goes to make up the cost of that pen, and then added to the called overhead or general expense, the proper share of taxes, insurance, what is predation, and salaries of the officers of the business, the superintendence, and what is ordinarily called unproductive labor. All those items of the indirect expenses have to be prorated onto that pen.

If you will add those items together, the cost of materials plus the cost of general expenses, that makes a sum of money. Subtract that from the selling price of this pen and you have what is called the surplus; and as you all know, it is over the division—mark my words—it is over the division of this surplus that all the labor disputes have arisen in the past. The eyes of employer and employee alike have been on the division of that surplus. The workman naturally wants all he can get of it in the shape of additional wages or in the shape of shorter hours, or in the shape of better working conditions. He wants all he can get out of the surplus. The eyes of employer can not come out of anything else. The manufacturer wants what he looks on as a fair share of the profits, and sometimes a damned sight more than his fair share. He wants all he can get out of the surplus. Both sides have had their eyes on the division of the surplus as the most important element. But the moment scientific management is introduced, the great change which comes under it is this, that both sides realize that if they will stop pulling apart, and pulling in opposite directions, and both push hard, shoulder to shoulder, as friends, cooperating morning, noon, and night in the most friendly, brotherly manner, it is possible to make this surplus so large that there is no occasion for quarreling over its division, absolutely no room for quarreling over the division. By this cooperation by this change from the attitude of antagonism to the attitude of friendliness, it is possible to make that surplus so much that there is no chance of difference. That is a total change in outlook from look-

ing at the division, to looking to the enlargement of the surplus as the great thing. That is one of the great mental changes that takes place on both sides. I want to emphasize that.

Now I will try to get on and tell you what scientific management is.

The CHAIRMAN. Go ahead.

Mr. TAYLOR. I am very slow in getting at these matters. Now I come to the essence of scientific management. I think I can make it clearer to you what the all recognize to be the best of the older types of industry, the best of the older types of management. I want to leave out all the subordinate types. I want to make it so that I think every one of you will say, "Yes; that is the best of the older types of management."

If you have an establishment, say, with five hundred or a thousand men in it, you will have 10 or 15 different parts at least. Now, the men in those parts have learned all that they know through tradition.

It has been handed down to them from man to man. There has hardly been a book written on industry that is worth reading, to speak of. I served two apprenticeships in my day, and all of my reading was confined to Joshua Rose's book on machine-shop practice. I think I read it through in two hours and a half. That was the only one available to the machinists in that trade, almost. Now hundreds of them are put out, but still I do not find the machinists or the apprentices reading very much. I have a boy who thinks he is going to be a doctor. I insisted that he should leave college at the end of his freshman year and work as a machinist, because I think that no matter what a young man is going to be he has got to get down to hard work early in life if he is going to amount to anything, or if he wants to have the best chance to get down to anything. So I insisted that the boy should get up at 5 o'clock in the morning, cook his own breakfast, and work as a workman at a good hard task under scientific management. He had no chance to loaf; he was not over-driven; I never was afraid of that in the least, nor was he, but he realized that he was up against a good hard day's work all of that year. I made him a present of a lot of books when he went into the industry, thinking that I would let him learn something about the theory of machine-shop practice. I bought him the nicest books I could get for him. He never opened them. At least, I never found any evidence of that. I never bothered the poor boy. I thought that getting up at 5 o'clock in the morning and getting his work out was enough. I never bothered him. I do not believe he read any one of them, and as far as I know, none of them ever were read.

What I want to emphasize is that our trades are learned just as they were in the Middle Ages. That is true of workmen, and I have no doubt the same term is used now as was used when I was a boy—you pick up a trade. You do not learn it. We always used to say, "I am picking up a trade," and you do it; you literally pick up your trade. You look at this fellow and that fellow to see what they are doing. It lies with yourself; it does not lie with some one else to teach you a trade any more than it did 50 years ago. I am not belittling this knowledge that comes from a trade. It is the greatest asset that a workman has—a trade. But the manufacturer, the boss, the superintendent who knows anything about the business, who has lived with his workmen, who understands the problem, must realize that his first object ought to be to get the true initiative of his workmen, to get their hard work and good will. A boss who does not realize that amounts to nothing, and if he realizes that, then he will have to say to himself, "If I am going to get the real friendship of my men, if I am going to get them to stop soldiering and to increase their output, I have got to pay them more or do something more for them than my competitors are doing for their workmen"; and if a man is large minded, if he is a big man, he deliberately sets out to do something better for his workmen than other people are doing for theirs—paying better wages and giving them shorter hours.

A man who deliberately sets out to do something better for his workmen than other people are doing for theirs, will get the benefit of it, and the workmen will grow less and less suspicious. They are justly and properly suspicious of any new scheme, or any old trick that comes along, for they have been tricked and tricked and tricked. They are properly suspicious of any new trick that comes along, and they think that it is a new trick, possibly a speeding up game to cut down their wages, but if a man will keep at that policy, in every case the workmen will respond and give him his money's worth. Why? Because they are just the same as all the rest of mankind. They are generous if you will treat

them generously, and they are mean if you will treat them meanly. They will do just what other people will do all over the world. I want to make a comparison between scientific management and the old type of management, because in each the employer deliberately sets out to give his workmen better things than other people are giving to their workmen, and in each the workman will respond by giving more work, more ingenuity, and everything else. I think you will recognize that as the best of the older types of industry.

I am going to try to show you beyond peradventure that there is no possibility of even this fine type of management competing with the practice of scientific management; there is no possibility of it. The practices of scientific management are so much more powerful that there is no possibility of even the finest kind of management competing with it.

The first of the great reasons is that under scientific management the men give their initiative, their good will, their hard work with absolute regularity. That, however, is the lesser of the two gains that comes under scientific management. The great gain that comes under scientific management consists of the new and absolutely unheard of duties and burdens which are voluntarily assumed by the men on the management side, new things that the management never dreamed of, new duties and obligations in the performance of the work that the management has to take over.

It is these great duties voluntarily assumed by the men on the management side that makes the vast improvement, that makes scientific management always better, inevitably better than even the best of the older types of management. These new duties have been divided into four large groups, and these groups of duties have been readily arranged under the present scientific management, and it is to the efficacy and the power of these different principles that I wish to direct your attention, and in which I wish you to become interested. It will not take very long from now on. I want to interest you in the four principles and to show you their great power.

The first of the great duties that are undertaken in scientific management that never were undertaken before, is that those on the management side deliberately start to gather in this great mass of intuitive knowledge, of rule of thumb knowledge, that has been in the minds, in the heads of workmen, and to tabulate it, to record it and to reduce it to laws and rules, and in many cases to mathematically formulate them so that when these laws, these new rules that never existed in the past, are used by cooperation in the management of men, it will prove itself of inestimable value. Mark you, this is done by the management, and the workmen are able to turn out without any more exertion an enormous increase of output, and this is simply through the gathering in of this great mass of rule of thumb knowledge and systematizing it and reducing it to a science. In other words, it is the development of a science out of this old rule of thumb knowledge, and it is from that element that scientific management has its name—the development of a new set of laws, where no laws existed, in place of the old rule of thumb knowledge that was in the head and the body of the workmen. That is the first great duty voluntarily taken over by those on the management side.

The second is the scientific selection, and then the progressive development of every workman in the establishment. It becomes the duty of those on the management side to study every single man in that establishment to see what his possibilities are, to see his limitations, and after having studied that man, to deliberately set up and raise him to a higher level in the first place—to a higher level of capacity and to a higher level of training and education, and then to higher wages than he had before. It is the study of every man and the making of every man. In the past we all know that with all well-managed companies they studied their machines. But under scientific management it becomes far more important to study, not a few men, but all men. Every man has to become a matter of personal solicitude, with the determination that you are going to raise that man higher in the scale than he has ever been before; that you are going to give him higher wages than he ever had before; that you are going to treat him as a friend. That is the second great duty.

The third is, and I wish you to mark it, the bringing of the science and this trained man together, for they will not come together voluntarily. You may train your man and develop your science, but unless there is some power to bring those two together the workman will go ahead as before, because none of us want to change in our ways and do something new, unless there is something to bring us together.

That word "bring" has a disagreeable sound. The greatest incentive to bring these together is this, that you show the man that if he does the new way in the first place he will get from 33 to 100 per cent higher wages. That is a powerful influence to "bring." Every time he carries out the new set of laws, he increases his output and his wages from 33 to 100 per cent. There is no uncertainty as to whether he does or does not carry them out. There is automatically increased his wage from 30 to 100 per cent. That is a powerful "bring." But, in addition to that, there is something more. There is the spirit of friendliness and cooperation; the spirit of, if you do your share I will do my share, which is the greatest element of all scientific management and cooperation and that produces the bringing. The word "bring" has a powerful sound, but it is necessary to "bring." Mankind is so fixed that unless somebody does the bringing they will not come. We are all fixed that way. Go and look into any enterprise and you will find that there has got to be a limit, there has got to be a 50, there has got to be something fixed or you will not rise to it; but I can soften the word "bring" by saying that nine-tenths of our trouble comes from the management side, and only one-tenth comes from the workmen. To make the new men do their work our trouble is mostly with the management and none of it, practically, is with the workmen. We never have any trouble with the workmen, but we have infinite trouble in teaching the management to do their new duties.

They start with the mental attitude, "Oh, yes; I would like this new thing; it is a new scheme for making men do more work"; but when it is pointed out that the greater part of this thing rests with them; that they have to do new things; that makes a difference. Oh no, they say, and our trouble comes in making them to do what they ought to do—that is, their share of cooperation. The force of the principles of scientific management lies in an almost equal division of the work on both sides, between the workmen and the management. The work which was all done in the past by the workmen and the management, great parts, and one of those parts is deliberately taken over by the management, so that there is actual cooperation in the bringing out of the work. In an elaborate machine shop doing miscellaneous work—I am not talking about repeat shops—in a shop where they do miscellaneous work—I am not will be one man on the management side and a number of machinists. That slice of work is deliberately taken out of the hands of the machinists and handed over to the management. When you have this great actual division of the work, when you have every act performed by every workman in the shop preceded by an act of some one on the part of the management, when no man can do his work right unless some man on the part of the management has performed his first, where there is an interchange of work all day long, you can not have the workman earn more wages and the management larger profits, the only hope of that is to outstrip your competitors, and in order to do that both parties have to work interchangeably with an absolute cooperation, with an absolute interchange of work. You can not fight with the man who is working right alongside of you, who is working for the same object. When you and he are working for the same object, you work together for that end or you quit. You can not go on working side by side for the same thing and be enemies. You must be friends. So, Mr. Chairman and gentlemen of the commission, that is the great reason of all why under this equal division, perhaps more than any other feature, there has never been a strike under scientific management. What is there to strike against, when you are all cooperating for the same end? There are no two objects.

I want to repeat these four great principles of scientific management, briefly: First, the development of science to replace the old rule of thumb knowledge; second, the scientific study of every workman and the progressive development of that workman in training and educating him, and bringing him to a better class of work; third, a better rate of wages; and, fourth, the bringing division of the whole work of the establishment together; and, fourth, this almost equal the actual work is divided into two tasks, and one of them is taken by the workman and the other by the management.

I am going to try to convince you of the power of these four principles, with several illustrations, and I hope during these illustrations you will see only these principles, and not that you will see something else that is interesting. I hope that you will see that the improvement brought about has been due to these principles, and not due to something else. I want to show you the

power of these principles. That is the reason I am going to give you the illustrations. Ordinarily, illustrations of this kind begin with pig-iron handling, and most people think that is the beginning and end of scientific management, whereas pig-iron handling has become almost a lost art. The moment I came to the Bethlehem Steel Works and saw men handling pig in the old-fashioned way, we started to get up machinery, and before I left there it was all handled by machinery. I have taken the illustration of handling pig iron simply because it is the most rudimentary form of labor known to mankind. Think of anything else that is as rudimentary. In the first place a pig usually runs about 92 pounds, and varies only a few pounds one way or the other. In the second place, the man who handles that pig handles it without any implements but his hands. Is there anything more rudimentary in labor than picking up a piece of uniform weight with your hands, carrying it off a few feet and dropping it? But I am not going to give that illustration, because it takes almost half an hour. If I had the time I could show you beyond peradventure that the science of handling pig iron is so great that the man who is fit to handle pig iron can not possibly understand the science. That is true of almost all industry. The higher up in any industry, the more true it is that the man who is fit to do the science can not possibly understand it.

I am going to show you a little later that the man who is fit to do machine-shop work can not possibly understand the science of it, it is so great. That is true of pig-iron handling, and that is the reason I take that illustration. That show the effect and power of the science. I can not take that illustration, to and that is shoveling. I dare say that you people will think that there is not much science in shoveling, but I want to show you that there is, and how powerful that is, and its effect on the workman. If any of you gentlemen would probably sit down right now and use your imagination. You would not have to go outside and watch men shoveling. Within two days you would have mapped out enough work for yourself to last three or four months, and that in developing the science of shoveling. There is so much to it. When I first came to the Bethlehem Steel Works I went to the old office there, and looked out of the window. Nearby there was a lot of cars loaded with rice coal, and there were four or five men shoveling that rice coal. After these men had unloaded the rice coal they walked to another part of the yard where there was a pile of ore from Mesaba, and with the same shovel they shoveled that ore. In shoveling the rice coal they took a load of three and three-quarters pounds on their shovel. When they were shoveling the ore they took a load of 38 pounds. It does not take very much science, or very much of anything, except the plainest horse sense, to see that if three and three-quarters pounds is the right load for that shovel, 38 pounds is the wrong load. That is common sense.

There is no science about that. Science comes in when you deliberately set out to know what is the right shovel load. I want to show you gentlemen this new change in the mental attitude. The old way of finding out the proper shovel load is to sit down and write to half a dozen contractors and say, "What is the proper load for my men to take on a shovel? You get an opinion from those men, and you write it down, and then you say that is the law. That is the usual way. However, there is another way that is the common way. You say to yourself, "Why, I have a good foreman, Pat, who has been shoveling for me here for a long time. He is the best of shovelers for the last 10 years and I will call him in and ask him about the proposition." So you call in Pat and you say, "Pat, what load ought your men to have on a shovel?" I will tell you that my Irish friends are resourceful, and they are never at a loss for an answer. Pat will tell you right off, about 12½ pounds. He is not going to be stumped with a question like that whether he knows about it or not. Then that becomes the law, and that is the way the law is gotten under the old management—12½ pounds. That is quite the way the law anyone, you say that is up to us and that we have to know what the proper load is. What we did long before we struck the Bethlehem Steel Works is this: We sent for two good shovelers, big, powerful fellows; well suited for their work. Mark any words, we never take a human instrument that is badly suited for its work any more than we would take a bad machine. We take a proper human animal, just as we would take a proper horse to study. If you wanted to study the hauling of coal, you would not take a pony and study him, but

you would take a dray horse, and in the same way you would take a man who is suited to shoveling. Now, we say to Mike and Jim, "I want you to do a whole lot of fool things. This is no joke. We are going to pay you double wages while this is going on, and all we ask of you is to do what that young fellow is going to ask you to do, what is perfectly right. He is going to say, I want you fellows to work so that when you go home at night you will go home properly tired, not tired out, but properly tired, for you men know how a man ought to be at the end of a proper day's work—not exhausted, but so that you could go right straight through this thing for years."

Let me say, Mr. Chairman, that under no condition or circumstance is it the policy of anyone connected with scientific management to overwork or hurry anyone. The word "hurry" is unknown in scientific management. You never can do decent work when anyone is hurrying. On the other hand you insist that you shall have the right implements, that the right men shall be chosen for their work, that ultimately in the selection of men you will get the right man doing the right work, and you will insist that the man who is shoveling shall go home properly and reasonably tired, but not exhausted. We told these men what they were to do, and we said, "This is no joke, and if this young fellow catches you soldiering, you go out and never come in again. You need not do it unless you want to do it. We are simply asking you to do a proper day's work, but if you soldier or try to shirk, if you take it for a joke, this young fellow will be onto you, and you will go out and never come back again. Those men undertook to do that, and they were absolutely square, and I have always found my workmen friends as straight and fair as other men. What we did then was to start them up against a big shovel load first. We started with a large shovel load, and we took the number of shovels they used during the day. Many hundred other records were taken. These two fellows were put in different parts of the work, with different watches. At the end of the day, after weighing the shovel loads, we found that they took 88-pound shovel loads. We then found that they did a certain amount of tonnage during the day. We then cut the shovel off so that they would handle a load of 84 pounds, and immediately the tonnage work for the day went up. We again cut the shovel load off to 80 pounds and again the tonnage went up. Then it was cut off to 26 pounds and it again went up, and at 21 pounds, or at 21½ pounds, they did their biggest day's work. When we cut it off below that, the tonnage for the day went down. There is the scientific fact that a shoveler properly suited to his work will do his biggest day's work with a shovel load of 21 pounds. Let us see how far-reaching that fact was. That is one of the many elements of shoveling. There are many parts of it, and that is one of them.

Let us see how far-reaching that was. The workers in the yard of the Bethlehem Steel Works all owned their own shovels. We had to take those shovels away from them, and build a big shovel tool room, and buy 8 or 10 or 12 different kinds of shoveling implements, and equip this large tool room with an immense range of shoveling implements, so that for each kind of work the men would have the proper kind of shoveling implements. If he were to shovel rice coal, he would have an immense scoop which would take about 21 pounds. When he was to shovel Mesaba ore he would have a different kind of shovel. They went further than that. There were from 400 to 600 shovelers in that yard. In order to do our duty toward them, they had to study every man, every shoveler. Prior to that time they were handled in big gangs, by one or two foremen. We had to begin to study every single workman in the 400 to 600. We had to give them in advance specific directions about their work. We had to work out a plan for them. We built a labor office. It meant the laying out of this yard, two and one-half miles long and half a mile wide, in a big diagram, and arranging a specific job or place for each man, sending this shoveler to this place, and the other shoveler to the other place. It involved supplying each man with a new kind of shovel with one kind of shovel ore, another kind for sand, still another for coke or coal or whatever it was each man was to shovel. It required one kind of a shovel for soft coal, another kind of a shovel for hard coal—an entirely new shoveling implement. It meant that in order to do justice to each of these men we had to inform them the next morning, when they came on to work, whether they had properly made good the day before or not, because we insisted that no one should work with us who could not earn 60 per cent higher wages than were paid in that part of the country.

The first thing I did when I came there was to learn that the ruling wage was \$1 a day, or, I believe, \$1.05, an inconceivably low wage. I horrified Bethlehem Steel Co. by saying, "We are going to pay \$1.15 right off to our labor." They thought that was wild. I said, "Not at all. We are going to pay \$1.15. We are not going to pay the lowest wage, but we are going to pay the highest price in this part of the country." I said that every man on this work must earn 60 per cent more than \$1.15 before we were through with them. I said we would have the men trained so they could earn 60 per cent higher wages than they were then earning. It is not just to a man to keep him working three days and then tell him, "You have not made good." Every morning, when these fellows come in, they reach their hand into a little pocket—most of them could not read and write, but they could find their way to their pocket—and pick out two pieces of paper. One of those directed them to the tool room, told them what implement to get, and the part of the yard in which they were to work, or start their first day's work. The second slip of paper was either a yellow slip or a white slip. If it was a yellow slip, they knew they had fallen down yesterday that they had not earned 60 per cent higher wages than the average. They knew they had not earned 60 per cent higher wages, and that something was wrong. They had a chance to look back over yesterday's work and see what was wrong, to say "What did I do that was wrong?" If they could read and write, they would see where they had fallen down. Most of them could read and write. Those who could not read and write were supplied with that information.

When a man got three or four yellow slips, this would happen: I want to point out this in the mental attitude of the men under their new duties under scientific management. When a man had three or four yellow slips under this method, under this new system, instead of feeling anxious and stirred up and unhappy, and saying, "Oh, hell, something is going to happen," as they used to under the old system, they said, "I have gone wrong somewhere." Under the old system every man knew what would happen if he had three or four yellow slips. The foreman—and I am not complaining of the foreman, because it is what I would have done if I had been that foreman—would have said, "Here, Pat, you have four or five yellow slips; you are no good; get out of here. You are not a high-priced man; get out of here." That is the old way.

The new way I want to point out. When it was learned that so-and-so had three or four yellow slips, one of the teachers was then told "So-and-so has fallen down for four days; go down and see what is the matter." If possible, the man who originally taught him was sent to him; the man who originally taught him to shovel was sent down. Along would come his teacher—not the old fellow with glasses on, or with a college degree, but a star performer with a shovel. Not only that, but a man who had sense enough not only to shovel right myself, but to show other people how to shovel right. That man would go down to him and say, "Mike, you have three or four yellow slips. What is the matter? Have you been drunk? Are you sick? If you are sick, or anything is the matter with you, we will give you a chance somewhere else while you are getting better." "No; I am all right." "If you are not sick and have not been drunk, and if there is nothing wrong with you, you have forgotten how to shovel. I taught you how to shovel. Come on, I want to show you how to shovel." He would simply stand there and watch him.

There are many, many ways in which to get along with a shoveler; many, many ways in which a man can get along shoveling. You may smile at such a thing as that, but shoveling is quite an art. There is a good deal of knack in knowing how to shovel right. In the throwing of your shovel to keep your load together, as you have seen if you have watched a real good shoveler. You will see that he will load his shovel in one way and throw it in one way, whereas he would have to be another kind of a shoveler if he were shoveling fuel into a boiler. If you are shoveling coal into a boiler—and I presume some of you gentlemen have done it; I have done it—you have to handle your shovel in a certain way. But in shoveling any other substance, it is a totally different thing. In shoveling coal into a boiler you must have a little shovel and know how to spread over the grate. With hard-coal firing it is absolutely necessary to do that. The art of shoveling is a great one, and there are many parts to it. I am only throwing out one or two of them. Every one knows that knows anything about shoveling, that if you are going to shovel right you must shovel, if possible, from an iron bottom, and if not

from an iron bottom, then from a wooden bottom, and if you do not have a wooden bottom, then a hard dirt bottom. There is less trouble then than when you have to go right into the top of the pile. When you go into the top of the pile a great part of the exertion is put forth and a great part of the energy is lost in getting your shovel into the pile. That is the difficulty—getting it in. When you study the art of shoveling it is a different matter. Every workman is taught to take a shovel into his right hand and push into the pile—to first get the right shaped shovel, and that comes from the tool room. He must have a sharp-end shovel. Hold your right arm down on your hip, and when you shove into it, push forward with your body like that [indicating], and throw the weight of your body on it. There is no arm exertion in that. That is the whole question, simply throwing the weight of your body forward. Time and again we would find these workmen who had been told how to do this, and then found their yellow slips, had forgotten that and had gone back to shoveling with their arms. That is impossible; the exertion is much greater. It takes two or three times as much exertion to shovel in that way. That one little correction would sometimes bring a man back.

It is things of that sort that affect their mental attitude. If that man fell down, it was probably from the fact that he was not taught right. We have not been with him long enough in the first place. But that man would stay right alongside of him, perhaps a day, watching him all day long, and whenever he slipped up in any of the elements of shoveling—and there are a good many of them—when he showed he had forgotten how to have that little jerk at the end when he wanted to keep the load together, he would show him how it was done, how to do it, until he learned just how to do it.

I am not talking to you people about shoveling because you are particularly interested in shoveling, but I want you to see what I mean by this development of the art of shoveling first, and then our duty toward the man. It is our duty to train and develop and raise every man up to a higher level. It is our business to be honest to that man and to teach him, not to "nigger drive" him, not to go for him and call him names and "holter" at him. That is no part of scientific management whatever.

The question must come into your minds, Does all this thing pay? Does it pay to teach your workmen all this? Can you make your dollars and cents meet with all this? If we have to build a new labor office, if we have to build a new shovel tool room, if we have to put in a telephone system, if we have to put in a messenger system, if we have to have clerks work all night, does it pay? Yes; I say it does. We are individualizing every man. It is our duty to measure each single man's work and help each man if we can. This corps of study men and clerks and teachers means money. If it does not pay, there is nothing in scientific management. Mark my words. It is not entirely a philanthropic scheme. It must pay both sides; it must pay the workman and it must pay the employers and pay them well, or there is nothing in scientific management; at the end of three and one-half years we were able to know whether it paid. In the last six months practically every man in that yard was on task work, whereas when we came there there was no man worked that way. They fortunately had records there of what it costs. They handled several million tons a year in that yard. It costs between 7 and 8 cents a ton, and that is low. In railroad work the average price is between 9 and 10 cents. A figure between 7 and 8 cents is a low figure. When you add all this overhead cost and all this teaching and the salaries of all these officers, when you pay your men 60 per cent higher wages—and every one of them was paid 60 per cent higher wages than they could get around that country anywhere—the cost of handling a ton was reduced from between 7 and 8 cents to between 3 and 4 cents, and the actual saving to that works in dollars and cents during the last six months was an average of between \$75,000 and \$80,000 per year. There is your justification, the workmen earning 80 per cent higher wages on the one hand. We had every man examined very carefully. There were 140 working then. When we started there were between 400 and 600. A great many people say, "Yes; they were driven out of the works to jump in the river and drown themselves." If you will ask me later I will tell you what became of them, what became of that difference between the 400 to 600 and the 140. This is generally the thing prominent in people's minds, so I am anticipating just a little. If you are interested enough, I will tell you later what became of those men.

When those fellows were happy, contented, receiving higher wages than they have ever supposed, not a man overworked, only 2 of them said to be

drinking men out of the 140—I mean to say, heavy drinkers—that justifies both sides—increased profits on the one side and increased pay on the other side. That justifies the corporation and the men.

I want to give just one more illustration. I want to jump into a higher field, and that is machine-shop work, and I want to say to you again what I started to say, that the science of doing work is always so great that it is impossible for the workman who is fit to work under it to understand that science. I will try to make good in that statement. It is impossible for the workman to understand, the science is so great.

My friend, Mr. Barth, went to a large company who wanted to change over from the old system—the old-fashioned way of work to the new. They had piecework in that plant, and wanted to change to the new way. This company employs between 3,000 and 4,000 men; I think more than that now. The department in which Mr. Barth was going to do his work was manufacturing a little machine about that square and that big [indicating]. That is repeated work, repeated over and over again. It is a patented machine. There were 300 or 400 men in the department that had been making that same machine for some 12 years. Naturally they had become very skilled in their work.

Mr. Barth, I think, horrified the owner of the business by telling him in advance that he would be able to get twice as much work out of that department as they had been doing. Naturally, the gentleman became rather perturbed about that, and, after some little sparring, Mr. Barth suggested that a test should be made of the machine to see whether this could be done. A very fair machine was selected by the gentleman, and then a record was kept of how long it took to do work on that machine. It was written down by all of the parties. It was agreed to. Then, Mr. Barth put in, in the same articles, but articles which were typical, and showed the workmen how to do that work, and made his test. I want to show you what he did first.

These employers made this test for the purpose of investigating the machine. It is our business, when we go into a shop, to study not only the men, but also to study the machine, and study them in a manner in which they have never been studied before. We are not doing our duty to the workmen unless we get them the very finest implements—unless we study these machines and know all about them. The only way you can study a machine in the machine shop is by means of these slide rules. This rule [indicating] will solve any belting problem, however intricate, and will solve it in a few seconds. Some of the machines are run by belt and motor in a machine shop. This will solve any belt problem in a few seconds. The other one [indicating] will solve a gear trouble in a few seconds, and they are quite difficult, some of them, more or less difficult of solution. But this slide will solve any gear trouble in less than no time. This one [indicating] will tell you the exact pressure which a given shift will have on the tool you are cutting with. It will give the depth of the cut and the feed—whatever the nature of the metal you are working with. This will tell him how many thousands of pressure will act on that tool. The fourth one will tell you the proper cutting speed at which to run that tool so as to have your tool edge wear out at the end of half an hour, an hour, or whatever time you desire. By the use of this method it was possible for Mr. Barth to write a prescription for the respeeding of those machines. Gentlemen, I want to state a fact which is realized by very few people—machines are not only badly speeded, but they are outrageously speeded. They are speeded so badly it is inconceivable. They are 200 to 300 per cent above what they should be. You may think that is a very broad assertion and a very great piece of exaggeration.

I was asked to speak before the Tool Builders' Association, the people who make these machines, in their convention at Atlantic City. They were all there—the owners of our large machine shops and their engineers. I said to them what I am saying to you. I said: Now, gentlemen, in your own shops, your own machines are speeded 200, 300, or 400 per cent wrong, and you know it if you know anything. They were speeded years ago by some one's guess. They have never been speeded by science. Some of your modern machines are right; but the great bulk of them are all speeded wrong." I threw down that challenge to them. Not one of them took up the challenge. I said: "If any of you would like to take up this challenge, I will show you that your machines are speeded wrong." I do not want you to understand that I am exaggerating, because that is a fact. Mr. Barth found that the machine which he examined was speeded all wrong, and he wrote a prescription for it—just

how it ought to be speeded. What I am trying to do is to show you how it is that a man equipped in the art of cutting metals is able not only to move than compete, but is able to do two, three, or four times the work that it is possible for the finest mechanic in the world to do who does not know that science. There was a machinist who had been working for years on this same basis, on the same lathe, but what could that poor fellow do when his lathe was speeded wrong? His lathe was speeded 200 or 300 per cent wrong. What chance had he? He had no chance at all.

But I will show you how much chance he had—even if it had been speeded right. I will show you that pretty soon. At the end of a week Mr. Barth came back with a slide rule like this one which I have here. He went home and made an instrument like that, which is used for running all the machines in our machine shop. Every machine in the shop has an instrument like that to run it with. This instrument embodies the laws of cutting metals. By the use of this instrument Mr. Barth was able to show that same man how to do his work so that his smallest gain was two and one-half times as much, and I think his largest gain was about nine times as much. By this instrument he was able to accomplish that much. It is not Mr. Barth's skill. The results of years and years of experimenting are embodied in this. I want to show you why that is. I want to make it clear why this science amounts to so much, and what it is.

I came to the Midvale Steel Works as a laborer and then got to be a clerk, and then I was in the tool room, and then finally got to be a gang boss of the machines and then foreman in the shop. When I got to be gang boss of the machines I knew the whole game. The owners of that business thought they were running the business. The owners of that shop thought they were running that shop. It was a piecework shop. It had been running a night gang and a day gang. The owners thought they were running it. We knew they were not. We had the work carefully laid out so we were doing about a third of a day's work. Every young man who came in there was told, "Here, don't do more than two or three pieces before noon. We will tell you the game at noon." When I became a gang boss they all came to me and said, "Fred, you are not going to be a piecework hog, are you?" I said, "I am going to get more work from these lathes. I have been straight with you fellows, and now I am on the other side of the fence. I am going to get more work out of the machines." They said, "Then take it from us, we will have you over that fence inside of three weeks. That means war. We will wipe you out." I said, "All right; very good."

That started a fight, and a despicable fight. Any man who has undertaken to drive a lot of men to do something against their interest—to force them to do things they do not want to do—is up against a mighty men proposition, let me tell you, and no man, I do not care who he is, can welcome such a thing as that if he has any sort of decency or any sort of feeling about it. There is nothing in life that is much meaner to do. I had three years of the hardest, meanest, most contemptible work of any man's life to do in trying to drive my friends to do a decent day's work. They believed it was not for their interest to do it. They were determined not to do it. I had the backing of the company in a remarkable manner, or I could not have gotten anywhere. But I had the thorough backing of the company, so at the end of three years I succeeded in winning out, and have doubled the output of the shop; but I can tell you I was not proud of it. No man can be proud of such a performance as that. He can only feel the disgustiveness of it. At the end of that time I was determined to quit that business and go into something else, or find some remedy for that state of things. It is a horrible state of things where every man is against you and you are against every man. If any man has ever been through it he knows how mean and contemptible it is.

When I got to be foreman of the shop and had finally won out and we had an agreement among the men that there would be so much work done—not a full day's work, but a pretty good day's work—we all came to an understanding and had no further fighting. Then I tried to analyze it, and I said, "What has been the matter with all this thing?" I said, "The main trouble with this thing is that you have been quarreling because there have been no proper standards for a day's work. You do not know what a proper day's work is. Those fellows know 10 times more than you do, but, personally, we do not know anything about what a day's work is. We make a bluff at it and the other side makes a guess at it and then we fight. The great thing is that we do not know what is a proper day's work." I went to Mr. William Sellers, the president of the com-

pany, and said: "I want to spend some money—a good deal of money—in trying to educate the foremen of our shop and the superintendents of our steel works in what a man ought to do for a day's work—what is fair, just, and right for a man to do." He said that thing had been tried a good many times, but there was nothing in it; that I could not work it out. Finally he gave in and allowed us to spend money, chiefly because we had been successful in his fight. He appreciated that it had been a stiff fight, and out of personal regard he allowed us to start.

The first thing we wanted to do was to settle the question which every mechanic and machinist had supposed was the essence of the whole matter, and that was, what was the proper angle for tools, what was the proper clearance angle, what was the proper slide slope, and what was the proper back slope. Our machinists all thought if we could get the right cutting angles, those three angles, they could do a great deal faster work than they ever did before. So we started to find out, and it was an extraordinary thing that we were the only shop in Philadelphia that could have found that out. We happened to have a great big pile of uniform metal to work on. We had 2,000 tons of locomotive tires—plenty of them in the scrap heap. That was metal of a uniform type. So we had plenty of splendid metal to work on, and we had the we started men to work right along and varied the cutting angles, and kept a record of what we did. For six months those experiments went on, and at the end of that time we had arrived at the extraordinary fact that it did not make much, if any, difference what those cutting angles were as far as speed went. We got only negative results. I told Mr. Sellers that and he laughed at me, and said, "That shows the whole thing. There is a lot of money blown into the fire." I said, "That is all right, Mr. Sellers, but let me show you that we have uncovered a gold mine of information. We have got to the top of a gold mine, and I want to show you what it is." When I was able to show Mr. Sellers the information we had already got, and that we were on the track of getting, which would enable our men to go faster and better work, he said, "Go right ahead and spend the money. I don't care." They started then to spend money on these experiments, which went on throughout practically the whole time I was at the Midvale Steel Works. Men were all cutting up chips to try to find the art of cutting metals. Then, when I left there our methods of financing these experiments were at an end. We could not go on there. Then, the only way we could carry on the experiments was to swap the information we had with anyone who was able to furnish the materials and the men to conduct these investigations. By the means which I have stated, we have developed the art of cutting metal. For nearly 26 years, almost without cessation, men were engaged in developing the science or art of cutting metals. That seems preposterous and ridiculous, to think of that length of time, but when you see the magnitude of the problem, even those of you who are not experimenters will realize the difficulty and almost the impossibility of success in the art of cutting metals there are 12 variable elements, 11 of which have been kept constant while the twelfth is varied; and the difficulty in holding them constant is next to impossible.

What do I mean by that? You must get uniform metal. You must have about 20,000 pounds of metal in order to make a single experiment. That metal must be absolutely uniform in quality throughout its 20,000 pounds. To get a mass of metal weighing 20,000 pounds that is uniform is next to impossible. The way we solved it was by using the same method that is used in gun forgings, by using the finest steel that could be had, hydraulic forging, test bars until we had refined the grain until it had been so refined that it was uniform all the way through. Then we were able to eliminate one of the great difficulties, and one of the variables became practically constant. We had 20,000 pounds of uniform metal. It would very often take six months to make the forgings in advance, ready to continue these experiments. I point that out merely to show how it was that anyone could take 26 years in carrying on a series of experiments. During those 26 years to show you the magnitude of the work, we spent about \$200,000 in wages and material. About 800,000 pounds of metal were cut up into small chips while we were studying the conditions and laws. The number of recorded experiments alone, those that were written down, amounted to some 50,000, and the unrecorded experiments amounted to many more.

You may think I am showing this to show that Mr. Barth and Mr. Gantt and a lot of our friends are remarkable men. Nothing of the kind. I am saying this to give you gentlemen a bird's-eye view of what is going to take place in every industry and in every element of every industry, something similar to this that is going to take place as sure as fate. The information that in the past has been in the heads of workmen is coming out of the heads of workmen, to be reduced to law, to be reduced to science, and then, through the cooperation of both sides, is going to enable the workmen and the company when they join hands to turn out an enormously increased output. And from that increased output is coming vast good both to the workmen and to the whole world. That is what I am pointing out.

Let me call your attention to one other element. During 18 years, or a part of 18 years, we had mathematicians employed in solving the mathematical problems that came up. Every one of these laws had to be reduced to a mathematical formula. Then we found ourselves with 12 mathematical formulae to use in solving an ordinary machinery-shop problem. I dare say some of you gentlemen do not know what a machine-shop problem is. It is a thing which every workman has to settle when he puts a piece of work into a lathe, to know what speed to use, and what feed to use. The workman has to settle those things every time he puts something into his lathe. He has to settle every time, "What feed shall I use and what speed shall I use." And in answering those two questions you need this great mass of mathematical laws, 12 great mathematical formulae.

Think of it. After we develop these 12 formulae, a man with the facility of the average mathematician could solve the problem by hand, writing it all out, in from 4 to 6 hours. Think of the absurdity of taking 4 to 6 hours to solve a mathematical problem to tell a workman how to run a cut that does not last over 15 minutes. The average cut does not last over that length of time. To tell a mathematician to spend 4 to 6 hours to tell a workman how to run a cut that takes 15 minutes seems preposterous and a farce. For a long time it looked that way. Now, there are hundreds of these mathematical sciences being developed, and anyone who has had any experience in developing anything of this sort will realize that what at first seems an absolute blank wall of impossibility becomes entirely possible and easy before you are through. That 18 years of mathematical work is an illustration of the amount of labor which was involved in this problem, until finally it has resulted in this work which Mr. Barth has done. I think we will all agree that Mr. Barth is far and away the best mathematician who was ever on this work. I do not want to detract at all from Mr. Gantt, who is much better than I was or could be; but I think Mr. Gantt will also give the palm to Mr. Barth. However, the problem was very nearly solved—you may say the great bulk of the problem was well on toward solution—when Mr. Barth took it. Seven different mathematicians have worked on this problem one after another, Mr. Gantt and Mr. Barth having done the finest work of the seven, beyond any doubt.

Through their work this slide rule was made, which in the hands of the ordinary workman, who knows nothing about mathematics, enables him to solve that problem with 12 unknown quantities in it in about 20 seconds. This is the first case in mathematics in which it has ever been possible to solve a problem with 12 unknown quantities and do it with any degree of rapidity. In proof of that I will say that as this thing went on I went time and again and applied to mathematicians in different parts of this country for a solution. Whenever I heard of a mathematician in a university I said, "I will pay you any price if you will give us a quicker solution for this problem." Most of them sneered at me and said: "My dear boy, you can solve a problem if you have an equation with three unknown quantities. You can solve it if you have four unknown quantities, rarely five, and never six; and this is an indeterminate problem, and you can not solve it by any known means except trial and error." That was the answer we got from all the great mathematicians. What I want to emphasize is that here are very ordinary men, Mr. Barth excepted. The rest of us are very ordinary mathematicians, and yet by simple digging and hard work and keeping at it, giving time to it and putting money into it, we were able to solve what the world recognizes as a very difficult mathematical problem. What I want to emphasize is that no one should ever be discouraged in the development and application of science on account of the difficulties which he meets at the start. You should never admit the impossibility of doing a thing simply because it looks to be impossible.

Now, gentlemen, a slide rule of this type is made for every machine in the machine shop, and it represents a new code of laws, just as important as the laws of the United States. It is the first time that laws have come into industry to supersede old opinions. This slide rule represents the laws of cutting metals. No one's opinion amounts to anything when it is backed up against this code of laws. This code of laws is just as much above every man on the management side as it is above every workman. No man on the management side can any more go against that code of laws than any workman can go against it and violate it. It is the essence of scientific management.

There is another code of laws. There is a machine-shop time study, the most of which was done by my friend, Mr. Merrick, whom I see here. Mr. Merrick is responsible, more than any other man on earth for 10 or 12 years of development of the code of laws governing the actions of workmen in a machine shop. This code of laws is completely over and completely controls the actions of every man on the management side just as much as it is over the actions and controls the actions of every man on the workmen's side. And I want to call your attention to this fact, that for the first time in the machine-shop industry some one's opinions count for nothing. The opinions of workmen count for nothing; the opinions of foremen count for nothing. These laws control both sides. You may say, and it has often been said to me, "Yes; but all of these laws have been developed by the management. The workmen have had no part in it." It is an extraordinary fact that knows of no set of laws except these in which the workmen have had one-half of the share. The workmen have done all the work in developing that in running the machines, and curiously enough they have had one-half of the work of developing it, and the other man is a man trained from a workman, a trained observer, to study the laws to write them down, to record them, and to make them useful. It is a curious thing, but I know of no science that has ever been developed in which the workmen have had so large a part as in this science.

Let me now call your attention to this fact, which is the most important fact connected with it, that the interests of both sides in these laws are absolutely identical. There can not be the slightest opposition of interest in this thing. Under the principles of scientific management our only hope of continually paying from 85 to 100 per cent higher wages than the other people are paying is that we shall get a reasonable maximum output from every man in the place. That reasonable maximum of output must be something which shall never hurt anyone, even after 50 years of employment; which shall never overwork anyone; never hurry anyone. Unless we get that reasonable maximum it is impossible to pay from 85 to 100 per cent higher wages than your competitors pay. So the object of both sides is exactly the same. There is no conflict of object in it. It is just as important for the management to get these laws right as it is for the men. There is no such thing as tyrannizing; no such thing as asking too much, because these laws have to be tried out daily with the workmen of the establishment. They prove themselves false or they prove themselves right every day. Many of these laws were worked out and developed in the Link Belt Co., of Philadelphia. This particular code of laws is tried out every day by the workmen of the Link Belt Co. They work under these laws and that slide rule every day, all day long; and the proof that they are right is this: That 98 per cent of the men make good in their tasks every day. If these laws were wrong, 98 per cent of the men could not make good under them. They must be just as far as the workmen is concerned. They can not be wrong to the workmen, because 98 per cent of the men make good under these laws, and it is our duty to investigate and find out why the other 2 per cent fail to make good.

Now, one of three things could happen, and it has happened every time. Either we find that something is wrong about this code of laws—that is one alternative—or second, some man on the managing side has had the code of laws wrong; has made an error.

Third, it may be that we have not properly trained the workman, that he is not up to his work, or has slipped up for some reason. We find that the mistakes are about even between the management and the men. The management makes mistakes and the men make mistakes, and I want to emphasize this, that when a mistake is made, all that it is necessary to do is for any workman to say, "This is a mistake. This code of laws is wrong. I have failed to do my proper task." It is not a question of alleged cheating, and saying, "I know these things. You have got to do these things." Why, no. You say,

"Something is wrong. An investigation has got to be made, there is no doubt about it. Let it be made." There is no doubt about what the orders are. There is no doubt about whether these laws have been or have not been justly applied. Every workman gets a time-table like that [indicating] every day, and every time he does a thing, he has this table to tell him how many minutes he has got to do this, that, and the other thing in, under the code of laws, so that whenever a thing goes wrong, the workman says, "Here, you ask me to do this piece of work in 12 minutes. I can not do it in 12 minutes."

Then an investigation has to be made. Either our slide rule is wrong, or the workman is wrong. An investigation is made of which the workman is a part. He is part of that investigation. It is not made outside. That workman is every time satisfied either that it is wrong or that it is right, and if it is wrong, that code of laws is altered. Of course it was wrong. Of course at the start any number of these observations were wrong, and they soon thrashed those out in actual practice, because they have a meeting of both sides, because both sides want to have them right. It is not for the interest of one side to have them right and the other side to have them wrong. Their interests are absolutely identical in that matter. There is no effort ever made to hurry a man, no effort ever made to nigger-drive anyone; it is by common consent; that is what we are after. A proper day's work, a perfectly reasonable day's work is what we want, and these laws are entirely open and aboveboard. No foreman can do what he ought not to do with those laws without it being found out. He has got to find out.

The record shows that the code of laws is right in most cases, but the men are just as anxious to have it spread and increased, and to have the correct result reached, as the management is. I remember when the Link Belt Co. reported 45 per cent of their men who were able to be given a task, they said, "We will never get beyond that. That is our limit." That is a tremendously miscellaneous company. They said, "We will never get beyond 45 per cent." I said, "Oh, wait a few years." When they got up to 75 per cent they said the same thing. We are now at 80 per cent of the men on the high bonus under those time-tables. Why is it?

Let me tell you, gentlemen, that the difficulty is on the management's side. It is not with the workmen. We never have any trouble with the workmen.

The great difficulty is in training the men on the management side, getting our men trained so we can use these laws, getting them to understand how to develop these laws. That takes time and patience on the part of the management. It takes time and patience all the way round. It takes a firm belief in the fact that justice is being done or aimed to be done to people. While these men are being trained, of course things go wrong. These men are all fallible. But all the men came up from workmen. There is hardly a man on the management side that was not at one time a workman. They are human, and they are apt to make mistakes. When it becomes for the interest of all to have these laws right and have them applied right, you will have a new condition in industry.

Gentlemen, I want to emphasize of all things the immense new power that has come into industry through a code of laws that never existed before. That code of laws is above both management and men, just as much above the one as the other, just as much as the law of the United States is above both the officers of the Government and the people; just as much the one as the other. Under scientific management they are all subjects of the law instead of subjects of the union. For instance, let us have an illustration of what I mean by that:

There used to be a rule in industry, very largely, that men started to work at sunrise. Under the old régime, before there was any almanac, it might be a matter of opinion, we will say. Suppose we are going to start a company to-morrow morning. It might be a matter of opinion on the part of the foreman and the owner of the business, on the one hand, and of the workmen on the other hand, as to when the sun would rise. The foreman and the owner might say, "The sun rises at 5.30." But the workmen, on the other hand, would exclaim, "Oh, no; no such thing; the sun does not rise until 6.30." Under the old régime that would be a subject for collective bargaining. They could get together and bargain and thrash the thing out and say, "We will agree the sun does rise at 6 o'clock, and we will start to-morrow morning at 6 o'clock." The moment you have an almanac there is no collective bargaining. It is a fact when the sun will rise.

But those subjects which are subjects for collective bargaining—and I advocate it, and I strongly advocate it—I believe in unions; they are doing fine

work—but where these things which formerly were the main subjects of collective bargaining have ceased to be subjects for collective bargaining we have the facts before us. They are true or false, and if they are false they must be found out by experts, by men fit to do it wherever the case may arise, no matter what part of the world or where the case is from—the expert who is best able to discover and present these facts. You would not think of collective bargaining in the matter of whether there was an eclipse of the moon. You would in that case go to an astronomer. Many of these things are not subjects of collective bargaining; they are facts. They are true or they are false, and it is to the interest of both sides to get at the truth. Can anything in this world live in falsehood, anything worth while in this world? It is inconceivable. It can not ever be for the interests of any set of men to live in falsehood. I would like to show you, if you will allow me, a solution of a problem by this slide rule. I want to show how utterly impossible it was for the poor fellow to carry all these things in his mind. I will solve a problem for you, if you will allow me.

There is a book [indicating] which contains the annual addresses of the president of the Society of Mechanical Engineers. Some years ago I was surprised, just as much as would be any of you gentlemen here, to be told I was nominated to be president of the Society of Mechanical Engineers, and for about three months, while the nomination was on, before the election, my chest got larger and larger, and I had to have somebody back of me to hold up my head to keep me from falling over backward. Four days after the election I was given a dinner. My head and chest suddenly contracted when I was told I had been elected because the society needed reorganizing, and it was believed I was the man to do it. I had a big year's duty ahead of me.

One duty as president of the Society of Mechanical Engineers is to write an address at the end of the term, and, not being able to write an ordinary address, I decided to write up this series of experiments in the art of cutting metal. There is one series of experiments. On that little line [indicating] it would take perhaps a week's work to get those figures. Any one who has had anything to do with experimenting knows that the moment you get a piece of experimental knowledge you must lock it up in the safe, put it away from yourself, and never touch it again until you get to the end, because as you find yourself approaching a law it is next to impossible not to be biased in your judgment. At the end of six or eight months that information is taken out of the safe and spread out on a table, like that [indicating].

The next step is to take this set of figures, average them, and put them in the shape of little crosses on that diagram. Every one of that group of figures comes from a series of crosses. They are connected with little, fine lines, and then comes the work of the mathematician. He has to hunt up a formula which will put the heavy, black lines right through the other little crosses. That is the way mathematics has worked this out. That is the way this formula represents this law, embodied in this way.

After that is developed, that law is put onto this slide rule in the shape of these figures there, with relation to these and those [indicating], and the exact relative position of that set of figures with this and that [indicating] represents the same thing as that [indicating]. You have five ways of expressing a law. There [indicating] it is blind. There it is in the shape of a cross, next in the shape of a heavy black line, and next it is in that formula, and next it is there in that way [indicating]. These state exactly the same thing. There are five ways of stating exactly the same thing. We had 12 of these formulas, representing the art of cutting metal. I will show you how they should work. The first thing the workman has to decide is, how long do I want my tool to run without regrinding. He is told by a certain section of this rule that for a tool 1 by 2 inches it ought to be ground every hour in order to get maximum economy. It took a year and a half of experimenting to develop that fact. It is shown for each size of tool the most economical period it will run without regrinding. That is the first thing to settle. Next, what depth of cut shall I take? He might take from one-sixteenth of an inch up to 1 inch. We will say I take a quarter of an inch. He slides the quarter inch down opposite here [indicating]. Next comes, of great bearing, the kind of metal that is being cut. Chilled iron you can only run about 9 inches in a minute; mild steel you can run 350 feet in a given length of time. This [indicating] tells the kind of metal you are cutting. We will say it is class 13.

Next we have the power that must be employed. That work might be anywhere from nothing up to 5 feet in diameter. We will say it is 10 inches.

We will slide this [indicating] to opposite class 13. You can cut there with 1 tool, 2, 3, or 4 tools on the machine. We will say that a man is running two tools, or two men are running a machine with one man to each tool. We will use two tools of a quarter of an inch. For the pressure on the tool we slide this 10-inch diameter opposite class 13, and now we are ready to solve that problem. These are the needs of the workmen. These are the things the workman must know. The workman must know that "A" means to use his triple gear; he knows that "D" means to throw his drive belt to a certain place; and he knows that "S" means something else. Here is "3-A-F." Carry that with your eyes across in this way [indicating]; that is about three-quarters of an inch. There is "4-A-F"; carry it across; that is about three-sixteenths. Carry "5-A-F" across; that is about five-sixteenths. Because this one happens to be to the left of that [indicating]—and the workman does not need to know why—that is the proper speed indicated there.

Let me show you what that poor fellow had to carry in his mind who was up against this proposition. If you want your tools to be reground at the end of an hour, if you want a certain depth of cut, if you know the quality of your metal is class 13 you know the diameter of your work is 10, but it might be anywhere from that up to 16. You have to carry all this formula in your head. If you have two cutting tools, if the pressure on your tool corresponds to class 13 and you place the resistance accordingly, you will do your best work by throwing your driving wheel on the floor and your triple here [indicating], and following out the other items as I have explained them to you, as shown by this rule.

Under the old plan the workman had to carry all these things in his head; and besides that he had to respect his machine, and he had no hope of doing that accurately.

I want to thank you very much, Mr. Chairman.

The CHAIRMAN. You have covered the general subject. Undoubtedly the members of the commission have some questions to ask. Mr. Garretson, have you some questions to ask Mr. Taylor?

Commissioner GARRETSON. No; I do not know that I have.

The CHAIRMAN. Have you any questions, Mr. Weinstock?

Commissioner WEINSTOCK. Yes. Just a question or two, Mr. Taylor, if you do not mind answering them.

Mr. TAYLOR. Certainly.

Commissioner WEINSTOCK. Under this system of scientific management does the worker have a voice in determining the price or the premium he is to receive?

Mr. TAYLOR. The worker had no voice in that. I will go back, however, and show you the kind of voice he had. It may sound strange—it does sound strange to a man who has the old viewpoint—to be told that that is again a question which properly is one for scientific investigation. That is what we prefer primarily, that that is a question for scientific investigation. You want to do what is fair to yourself. I will show you how that is being applied primarily.

I had lots of friends in the Midvale Steel Works, friends just as intimate among the workmen as my brothers are, or as any friends could be. I went to a group of five or six of those fellows and said, "I would like you to go on such and such a kind of work and work for a premium of, we will say, 15 per cent added to your wages." I went to other groups at other kinds of work and offered 20 and 25 and 30 and 35 per cent. I said to these men, "Just work ahead at this and see whether you like it better than you did before. See whether this suits you." I said to them, "Mind you, you are now subject to limitations you were not subject to before. Some one now comes and tells you just how fast you are to do things and how you have to do them." That is disagreeable. No one likes that. It is not pleasant. Here is a set of laws, a new code of laws. I said to them, "When we tell you we want you to use such and such feed and such speed we want you to use it. You will have to act under certain limitations that you did not have before. We want you to do that, and then at the end of six or eight or nine months, after you have tried the thing, if you like it we will go ahead, and if you do not like it you may go back; we are perfectly willing to have you go back to the old conditions."

I should say one-third of the 15 per cent men stuck to it and the others wanted to go back. When it came to the 20 per cent men a larger number of them stuck and the others went back. Of the 25 per cent men more stuck

that went back but still more liked the old better than the new method—of those just coming under it, but not after they worked under it for any length of time.

When we got to the 30 per cent men all but one stuck, and at 35 per cent every man stuck and was satisfied with the new thing. There is an indication of a law, and you want to do justice. Mind you, the men were new and had come freshly at this new thing and they disliked it. No one likes new things; no one likes to change their ways right off if they have formed a life habit of doing things a certain way. The fact that when we got up as high as the 30 and 35 per cent men all of them stuck, was an indication that at least we were doing justice to those men; showing we satisfied some of them. We found them all very well satisfied with it, in fact. There has never been a question on the part of our friends whether this premium is just or fair. When it comes to a certain kind of work, you have to pay 100 per cent in order to be just and fair. That is not a question for collective bargaining. It is a scientific investigation. Let me make it clear to you: We welcome in every possible way the cooperation of every man in our establishment. We welcome the cooperation of the unions and will pay them for their cooperation; we welcome it and want it. We want their help. They could do immense things toward this.

The day is not far distant when they are going to ask for this being done, and that the machines in their shops be properly studied and properly speeded, so they can get higher wages, for you can not pay the high wages if you do not get the increased output, and you can not get the increased output if you do not along in the same sloppy way, and do not study your machines and do not make a science of every machine in the place, and if you do not study all your men and show them the best methods and give them the benefit of the experience of 100 shops instead of the experience of the old-fashioned foreman or the training of one man. You are not doing justice to your men. The time is coming as sure as the sun shines when the unions will take that up and insist on the employers doing their proper share of the work, that they shall make this proper study of their machines and do these other things. We welcome the help of the unions. What we do not welcome is when they try to put us out of business. I do not feel the slightest resentment against the union leaders because they have seen fit to roast scientific management, because in their ignorance of it they have written things about it that are totally untrue.

They say it is a nigger-driving proposition, a proposition to speed up. The thing I do feel sorry for is that these men who write these things will not come to our works and see for themselves. If they came they would not write that kind of thing any more.

The CHAIRMAN. May I make a suggestion for the purpose of speed? I was asked this morning to allow you to present your views in your own way; that is, to present your proposition in your own way. Of course, that was done. We would like, if possible, for you to leave off the argumentative part of the matter in your answers to these questions.

Mr. TAYLOR. Certainly.

Commissioner O'CONNELL. Of course, we want you to put your own system into effect here.

Mr. TAYLOR. Very well; I will accept that suggestion. Commissioner WEINSTOCK. Would it or would it not, in your judgment, be wise and expedient to give labor a voice in determining the premiums and prices?

Mr. TAYLOR. I think that the moment that labor asks for it they will have it. They have never asked for it before because they have looked upon what they were getting as just and fair. The matter has never come up before me as a question; the fairness of it has never come up. They have accepted things as they are, and they have never said that they were anything but fair. In fact, they are more than fair.

Commissioner WEINSTOCK. Then you would have no objection to giving labor a voice?

Mr. TAYLOR. Not the slightest objection. I would welcome it.

Commissioner WEINSTOCK. Just one more question, and I am through. You pointed out that the system of permitting things to be determined by mere opinions will soon be a dead system; that the system of the future will be based upon the facts.

Mr. TAYLOR. Yes.

Commissioner WEINSTOCK. Now, assuming that to be true, what will be the ultimate, when all production has adopted scientific methods; what will be the result?

Mr. TAYLOR. Going right back to fundamentals, now, if you do not bring wealth into the world you can not distribute it. The first thing, then, is to bring the wealth into the world, and then you can make your distribution. The first thing for the interest of the workmen—and they get nine-tenths of it all—is to bring in twice as much, to produce twice as much by our factories and our shops, to every year turn out twice the amount of production, and that is going to be distributed among the workers, and they will get it. That is the first thing. In order to accomplish that, men must coordinate. The workmen and the manufacturers must get together, and the managers must say, "We will show you how; we will choose the men, the most trained men, to show the other men." That is the first thing. Cooperation must take place between the two sides. In order that that shall take place the workmen must cooperate. It is likewise to the workman; there is a certain amount that is disagreeable about this cooperation. If you allow every man to do just as he damned pleases in one case and in another case give them certain rules which they must follow it is somewhat irksome to them, and workmen will not prefer that to the old method unless they are paid higher wages for it, much higher wages than they were getting before. There it is; this is what the world wants. This is the important fact in industry; about 17 per cent of the world is engaged in coordinated industry. The rest is engaged in some other form of labor, farm labor or town distribution, and so on; and this 17 per cent which is engaged in coordinated industry will insist that they rise that much higher above the dead level, and they will not be satisfied without it. The same ratio must exist between the dead level of the world's industry, that is the 83 per cent of the world, which fixed the wages of the world—the relative value of things—and these men who are cooperating in an unusual way, who are sacrificing themselves, if you choose to put it that way, who go into this great game of cooperation. It is just like a baseball team. You never will find a baseball team where one man is not called upon now and then to sacrifice. It is damned mean for a fellow to have to sacrifice when he might make a run, but he must do it for the benefit of the whole community.

The same thing exists in the industrial community. We have all got to cooperate. There have got to be certain things that are disagreeable about industry, and the men are going to insist, the men who are doing this thing for the benefit of the whole community will insist that they should get a proper pay above the rest. The problem is perfectly clear to me.

The CHAIRMAN. Do you deem that an answer? Is there anything else?

Mr. Lennon, have you any questions?

Commissioner LENNON. No; I prefer to give Mr. O'Connell, so far as I am concerned, a chance to ask questions.

The CHAIRMAN. Mrs. Harriman, have you any questions?

Commissioner HARRIMAN. Mr. Taylor, I should like to know what guarantee the workmen have under the present system that an unscrupulous employer will not speed them up—I mean under the system that you describe.

Mr. TAYLOR. Because, Mrs. Harriman, speeding up results in less work and not in more work. You can not hurry without that result. I defy you to go into any of our shops and look and find a man that is overworking, in our establishments. If you find any man in any of our establishments who is overworking I will give \$50 to any charity you say. Those who have seen our establishments say that the remarkable feature about them is the fact that there is no hurry in them.

Commissioner HARRIMAN. But they are all good employers in your establishments. I am speaking of the condition of ordinary workmen under unscrupulous employers.

Mr. TAYLOR. If any of you have ever seen our people, you will understand that it is a friendly game. The moment a man is speeded up he refers to these laws, and there it is. You can not speed him up while these laws exist. And as to those laws, mind you, now, you take the Watertown Arsenal. Of course, these laws are still being added to, but at the Watertown Arsenal there is very little chance for an unscrupulous employer to do anything of that kind, because they have these laws there. Of course, there are mistakes made. They are fallible and they do make mistakes; but when they make a mistake it is instantly found out.

You put something under a time table and you give it to a man and he says he can not do that. He says, "Come and show me," and you have got to go and show him. He says, "I will take this thing, and you take the stop watch and time me." The man can not do it, and if he can not, that settles it. When a man takes a task and the workman says he can not do it, and he says to the workman, "You take the stop watch and I will do this," and he does it, then he says to the workman, "I will take the stop watch now, and I will see what is the matter with you." Generally speaking, he finds that the workman is making some false motions, he has not got the right way of handling himself. That is the way this code of laws is thrashed out.

Commissioner HARRIMAN. Then, you think that the system itself is a guaranty against—

Commissioner WEINSTOCK. Overwork?

Commissioner HARRIMAN. Yes; against overwork and overspeeding?

Mr. TAYLOR. It is not as it was developed originally, but that code of laws which has been thrashed out, in which 80 per cent of the men every day have been making good, that has been proved. Every man on the management side is just as much under that code of laws as the workmen.

Commissioner HARRIMAN. Are there pacemakers in these establishments?

Mr. TAYLOR. We have no such thing as a pacemaker. When a man goes out to do that work he is an efficient man. We never choose an inefficient man.

Commissioner HARRIMAN. He is not an exceptional man?

Mr. TAYLOR. No; he is not an exceptional man.

Commissioner HARRIMAN. No; that is it.

Mr. TAYLOR. We insist that every one of our men shall be a first-class man—shall become a first-class man.

The CHAIRMAN. Mrs. Harriman says that is a sufficient answer. Thank you, Prof. Commons, have you any questions to ask?

Commissioner COMMONS. No.

The CHAIRMAN. Mr. Delano, have you any questions?

Commissioner DELANO. I think that I have understood what you have said, except one thing that you said in answer to Mr. Weinstock. You spoke of 17 per cent being coordinated workers.

Mr. TAYLOR. Seventeen per cent of the world's workers are coordinated workers.

Commissioner DELANO. I wanted to see if I understood—

Mr. TAYLOR. That is, engaged in manufacturing establishments and similar establishments where men work together, as against the gardener and the grocery man and the coachman and those engaged in distribution, etc. Gentlemen, mind you, in all that I say, in all the generalizations that I have made, about workmen, and in talking about soldiering, I have in mind only coordinated industry. My gardener is a much harder working man than I ever was in the world, and he has no incentive except kindness and honesty and decency. I never coached him in any way, and my working friends would not do it if it was not for their interests. It is no stigma on a man to soldier.

Commissioner DELANO. You spoke of dividing men up into groups. One should work at 5, another at 10, and another at 15, and another group at 30 per cent, and so on. Was any selection made of those men?

Mr. TAYLOR. No; we took them as they came. They were friends of mine engaged in the shop, and some of them in other shops—not all machine shops.

Commissioner DELANO. There was no selection of the men?

Mr. TAYLOR. No. What we were after was the truth.

Commissioner DELANO. I understand.

Mr. TAYLOR. We were not after somebody—Commissioner DELANO. I appreciate that. Now, has any careful study been made of the men themselves to find out whether they were really tired, those who performed these larger tasks?

Mr. TAYLOR. Let me tell you one thing. A great part of these things were made in a machine shop. We will say fourteen-fifteenths of the work was in a machine shop. Now, you can not overwork men in a machine shop; it is impossible to overwork them in a machine shop, because the periods of rest are so great. You can not overwork them.

The CHAIRMAN. The question is, was any study made of that thing, in that manner or otherwise, to find out if the men really were tired?

Mr. TAYLOR. Yes. Many of them were in the machine shop, and those men can not be overworked. Now, on vice work, heavy vice work, you can overwork them.

The CHAIRMAN. He was asking you about the ascertainment of that fact alone. Was there any effort made to ascertain if they were overworked?

Mr. TAYLOR. Yes; but they were not. They were not forced to do anything. The CHAIRMAN. Answering the question exactly as it was asked, an effort was made to ascertain?

Mr. TAYLOR. Yes, indeed. And remember, too—
The CHAIRMAN. That is the answer. There will be time perhaps for a little argument afterwards, but let us get through with the questions.

Mr. O'Connell, have you any questions?
Commissioner O'Connell. I want to ask you several questions, and if you will be as brief as possible in your answers I will be obliged. We will put your system into operation right here.

The law creating this commission provides that it shall seek to ascertain the underlying cause of industrial unrest. Do you consider the question of efficiency, as you have it in mind, one of the essential things for industrial peace?
Mr. TAYLOR. Indeed, I do. I think that without any question it is. For instance, in the case of the Link Belt Co., the average man has been in the employ of that company for eight years, as shown by this report before the House committee. And in a similar company, run by the friends of Mr. Dodge, a very notable company, one of the finest in this country, one of the partners came to me and said, with tears in his eyes, "The saddest thing that has happened in our industry in the last eight years is that we have lost 45 per cent of our men, changing every year."

Commissioner O'Connell. We have a great many efficiency systems—the Taylor system and the Emerson system and the Van Alstyne system and the Brumbacher system, and a great number of others. Relatively what is the difference between all of these systems? Can you not all agree upon some system?
Mr. TAYLOR. I am not bothering about other people's systems. I am only bothering about scientific management, and I can not criticize Mr. Brumbacher's system or anybody else's system. I have only tried to set forth ours, and, really, I can not criticize anybody else's system. I do not think I ought to do that.

Commissioner O'Connell. In what number of shops in the United States is the so-called Taylor system in operation?

Mr. TAYLOR. I can not tell you that. I know that I hear of new plants all the time, where they have been working at it for 6 or 8 or 10 years. I have been astonished to hear from them, I know—places that I never knew of. I never knew that they were working at it. I know perhaps of 100 plants, but I never knew that they were working at it. I really do not know how many there are in all.

Commissioner O'Connell. Have you any idea of the number of men who are employed under the Taylor system?

Mr. TAYLOR. If I should answer that, it would be only the reddest kind of a guess. I should think by this time there must be 150,000 or 200,000; but I do not know. I do not think anyone knows how many there are.

Commissioner O'Connell. You have been engaged in work on the system for 30 or 25 years?

Mr. TAYLOR. The first steps were taken toward forming it in 1881 or 1882.

Commissioner O'Connell. At the Bethlehem Steel Works I notice throughout your discussion you speak of the men never being overworked and all that. I find in your book here, on page 54, you say something about that.

Mr. TAYLOR. Which one of the books are you quoting from—Shop Management?

Commissioner O'Connell. Yes; Shop Management. I quote your language:

"When the writer left the steel works the Bethlehem pieceworkers were the finest body of picked men that ~~has~~ ever been seen together."

Mr. TAYLOR. No; that he has ever seen together.

Commissioner O'Connell. Of course, I am quoting you.

Mr. TAYLOR. Not "that has ever been seen together," but the language is "that he has ever seen together."

Commissioner O'Connell. That is what I said.

Mr. TAYLOR. Not "that has ever been seen together."

Commissioner O'Connell. Well, do not let us haggle over that word. I continue reading:

"They were practically all first-class men, because in each case the task which they were called upon to perform was such that only a first-class man could do it. The tasks were all purposely made so severe that not more than

one out of five laborers (perhaps even a smaller percentage than this) could keep up."

Mr. TAYLOR. Yes.

Commissioner O'Connell. Was that not an extreme task at which only one out of five laborers could keep up? Was it possible for them to perform the task?

Mr. TAYLOR. No, indeed; this refers to pig-iron handling, don't you see? There are very few men suited to pig-iron handling. To give you an illustration that I know will appeal to you: Most men have not studded men. All men have studded horses. Now, what we say is that a first-class man shall be chosen for his job every time. If you in Washington here were going to haul your coal, you would sooner or later insist that you should have it hauled by good, big dirty horses. You might take in an emergency, when you did not have the big horses, a grocery-wagon horse or some other small horse, but sooner or later you would say, "I am going to have good, big dray horses."

Commissioner O'Connell. We will quit raising small horses after a while, then?

Mr. TAYLOR. Not at all. We would have grocery-wagon horses to haul grocery wagons, and donkeys for hauling carts, and polo ponies for their work; but you would say that no donkey would haul coal for you in the future; that only Percheron horses shall haul coal. We were forced to say in the first place that we had not enough Percheron horses. The way those men came on that work, they selected themselves. They came right out on the street and said, "We would like to handle pig iron." There was no selection made at the time. There was a gang of a hundred men running along with a foreman, whether they were fit for it or not. We said, "In order that we may be able to pay these men proper wages we have got to get the Percheron horses to handling pig iron," and in order to do that we had to select them. There is no injustice in that.

Commissioner O'Connell. You say that the output and production of your plants, where your system has been in operation, has increased 100 per cent or more?

Mr. TAYLOR. Yes.

Commissioner O'Connell. Have the hours of labor been reduced in any of those plants, where the system has been in operation, to eight hours a day, where the output has been increased?

Mr. TAYLOR. Oh, yes; wherever it has been possible to do it. If you have read what I wrote about the Shlums Ruling Machine Co., you will remember the conditions that I found there—that I found girls that were working 10 hours a day. Without waiting for any system or anything else, I just knew that it was inhuman to work girls 10 hours a day.

The CHAIRMAN. Instead of arguing these specific cases, will you kindly answer Mr. O'Connell's questions and tell him what institutions you now have in mind where the hours were reduced to eight per day on account of this system being adopted?

Mr. TAYLOR. The Shlums Ruling Machine Co.

The CHAIRMAN. Any others?

Mr. TAYLOR. To eight hours per day?

The CHAIRMAN. Yes.

Mr. TAYLOR. Mr. Fife, who has just reduced in the clothing industry to eight hours a day.

The CHAIRMAN. Are there any others that you recall?

Mr. TAYLOR. I can recall lots of them that have gone down from 10 hours to 9 hours.

The CHAIRMAN. But no more that have gone to eight hours, that you think of now?

Mr. TAYLOR. I will look them up and write you about it.

The CHAIRMAN. Very well. That is enough.

Commissioner O'Connell. Has the Link Belt Co. reduced its hours?

Mr. TAYLOR. Surely; to 54 hours a week.

Commissioner O'Connell. How long has 54 hours been in operation there?

Mr. TAYLOR. Eight or ten years, I should say.

Commissioner O'Connell. How long have they had this system there?

Mr. TAYLOR. Just a little longer than that.

Commissioner O'Connell. Were they not working 54 hours a week when that system was put in?

Mr. TAYLOR. I do not think so. I am pretty sure of that. I am not positive of it. I am sure that the Taylor Co. has reduced hours. We always try to do that. But we will never reduce hours if we are going to make the men work harder.

Commissioner O'CONNELL. You say in your experience there never has been a strike occur where the efficiency system has been put in?

Mr. TAYLOR. I never said that; most emphatically not. I said where scientific management has been adopted there has never been a strike. There are thousands of efficiency systems.

Commissioner O'CONNELL. Has the Bethlehem Steel Co. reduced its hours of labor since that system has been put in?

Mr. TAYLOR. I have not been there myself for 12 years, but the last time I knew of it there were two distinct systems in use at the Bethlehem Steel Co.—our system in the fine work and the old-fashioned individual driving system in the rest of the works.

The CHAIRMAN. Then your answer is that you do not know whether scientific management is now in the plant referred to by Mr. O'Connell?

Mr. TAYLOR. I was trying to explain—

Commissioner O'CONNELL. The machine shop, you mean? That is, the department in which they have the finer work?

Mr. TAYLOR. Yes.

Commissioner O'CONNELL. Isn't it true that about two years ago there was a general strike in there which caused a general turmoil? The machine shop ran until they had nothing to work on, if I am informed right, and then they quit.

Commissioner O'CONNELL. The machine shop was where it was inaugurated.

Mr. TAYLOR. I beg your pardon.

Commissioner O'CONNELL. Have you ever heard of a strike there?

Mr. TAYLOR. Yes; but those men were not working under our system. Do you mean to say men that dropped down out of the sky? No; of course the men were not working under our system.

The CHAIRMAN. That is the answer. There is no use repeating it.

Commissioner O'CONNELL. Well, if the efficiency system was introduced in the foundry in the Watertown Arsenal, and the men went on strike—

Mr. TAYLOR. It was not introduced, because it takes two or three years to introduce our system anywhere. You can not introduce it in an hour. You can not develop this code of laws and introduce it in a day.

Commissioner O'CONNELL. I understand this occurred three years after the system had been started.

Mr. TAYLOR. The molten had not had a solitary thing. They had no talies and no time system, and nothing had been done. They struck at the drop of the hat.

Commissioner O'CONNELL. I recall reading in one of your books—just now I can not lay my hand on it—that it was necessary to inculcate in the minds of all those concerned that they must bear in mind constantly that this company is organized for the purpose of paying dividends to its stockholders. Do I quote you correctly?

Mr. TAYLOR. I think I can read you from this pamphlet what you are trying to quote.

The CHAIRMAN. Let me make a suggestion, that if any member of the commission is going to refer to any writing of the witness, the writing itself should be read to him, because it leaves so much room, if you do not do that, between the understanding and recollection of the interrogator and that of the witness that there would be no end of it.

Mr. TAYLOR. I have this right here.

The CHAIRMAN. One minute, Mr. Taylor. You say you have there the passage referred to?

Mr. TAYLOR. Yes. It is as follows:

"All employees should bear in mind that each shop exists, first, last, and all the time, for the purpose of paying dividends to its owners."

The CHAIRMAN. I understand you have some explanation that you wish to make?

Mr. TAYLOR. Yes.

The CHAIRMAN. Make it as clear and as short as you can.

Mr. TAYLOR. No greater piece of injustice—

Commissioner O'CONNELL. Are you quoting?

Mr. TAYLOR. No. I say no greater injustice can be done to an author than to take an isolated passage from one of his works and quote it. See the gross injustice of this. Here is a page that he points out, and this whole page is taken up in pointing out to the owners of a business that they ought to be decent to their men, that it is their duty to bring it to the highest state of efficiency in their shops. If they can not pay them higher wages, it is their duty to find work for them outside in other people's shops, and to hand over their good men, whom they have trained and paid their good money to train, to others. When I said that at the Midvale Steel Works Mr. Sillers (?) almost frothed at the mouth about that. I say it is their duty to promote their men and get higher pay for them. Then after pointing out that, I come around and say this to the workmen:

"On the other hand, this policy of promoting men and finding them new positions has its limits. No worse mistake can be made than that of allowing an establishment to be looked upon as a training school, to be used mainly for the education of many of its employees. All employees should bear in mind that each shop exists, first, last, and all the time, for the purpose of paying dividends to its owners."

Now, after you say that the employer ought to do certain things for his men, is it not perfectly proper to call the attention of the workmen to the fact that they ought to be decent to their employers, and that they must not look for promotion, and to the fact that those shops exist for the purposes stated here? Is it not injustice to me to take one of those things without the other and quote it, as has been done here?

Commissioner O'CONNELL. Do you believe in profit sharing between employer and employee?

Mr. TAYLOR. Certainly I do. We share profits every day. We give an increase of 30 per cent in wages.

Commissioner O'CONNELL. Do you believe that they should organize in their respective trades organizations?

Mr. TAYLOR. I believe in dealing with the older time type of employment; it is an absolute necessity. I have not as yet seen the necessity, under the newer system, and if there is any necessity, if it is for the benefit of the men, that is what I am looking for. If they can do better with it, they should have it.

Commissioner GARRETTSON. In response to Mr. Ballard's question, Mr. Taylor, as to whether a study has been made or as to whether men were being overworked, you stated that it was an impossibility for a man to be overworked under your system.

Mr. TAYLOR. In the machine shops, I said. It is an absolute impossibility that they should be overworked. The periods of rest are too long. The period of time necessary for a man to rest from work in order not to be overworked is absolutely established. All you have to do is to put a weight on a man's arm and to calculate how much of his time in the day he is under that weight, and you can see whether he is overworked or not.

Commissioner GARRETTSON. Whether he falls from exhaustion or not?

Mr. TAYLOR. No; but if men have been working with that load on their arms for generations and they are all right, then that is proof that they are not being overworked.

Commissioner GARRETTSON. Not even if they die from it?

Mr. TAYLOR. But they do not die from it.

The CHAIRMAN. We will take our recess now until 2 o'clock.

(Whereupon, at 1 o'clock p. m., the commission took a recess until 2 o'clock p. m.)

AFTER RECESS—2 O'CLOCK P. M.

The CHAIRMAN. The commission will come to order. Commissioner Weinstock has a question or two further that he would like to ask you, Mr. Taylor.

TESTIMONY OF MR. FREDERICK W. TAYLOR—Continued.

Commissioner WEINSTOCK. It has been held, Mr. Taylor, by the opponents to your system and its critics, especially among those representing organized labor, that while it is admitted that, temporarily, the scientific system increases earnings, in the long run it cuts the earnings. Is that true?

Mr. TAYLOR. I can not conceive of any such fact. I can not conceive of the application of scientific knowledge failing to do anything but increase earnings, because it increases output, and invariably you will find one thing is true: You can not increase earnings without output. You may increase output

without increasing earnings, but the only road toward a permanent increase in wages is an increase in output permanently. That is true the world over.

Commissioner WEINSTEIN. And yet, according to your own statement of this question, Mr. Taylor, if I understood you correctly, you said that in the beginning this increased surplus either goes to or has gone almost entirely to the employer; that later on the worker gets a part of it, but that, ultimately, the consumer gets it all.

Mr. TAYLOR. In this way: I was referring in that to the history before the introduction of our system. That is the history of the industry in the past. Look into the introduction of the factory system, and the employer got it all at first.

The CHAIRMAN. It does not apply to this system?

Mr. TAYLOR. Not at all. We absolutely safeguard our men.

Commissioner WEINSTEIN. Then, according to your idea, the present system means that this increased surplus is divided more or less equally among three factors—the employer, the worker, and the consumer?

Mr. TAYLOR. Yes; and, for the first time in industry, we have seen that, before anyone gets anything, the workers have their 33 per cent to 200 per cent.

Commissioner WEINSTEIN. That is the first objective?

Mr. TAYLOR. That is the first thing we do.

Commissioner WEINSTEIN. Then you deny the charge that scientific management gives the worker only temporarily an increase in earnings?

Mr. TAYLOR. I point to every one of our companies, as far as I know, where it has been introduced. You will find those same percentages are paid still, so far as I know.

Commissioner WEINSTEIN. Has the system been in operation long enough to determine that as a permanent condition?

Mr. TAYLOR. In the company that I originally went to, where I first introduced it—the Midvale Steel Co.; I have not been there for something like 22 years; I have not been inside of that company; but I believe you will find the same thing still holds true. I can not conceive of any set of American workmen continuing to stay, as they have, year after year, with one company, unless they found that they were better treated there than anywhere else. I know that my workmen friends are still at the Midvale Steel Co.'s works, and I know, also, that the managers of the Midvale Steel Co.'s works are the same that I trained and left there many years ago. I can not conceive that things should have changed, although I know nothing about it. I have no personal knowledge of the matter.

Commissioner WEINSTEIN. It has also been contended that the scientific management system tends to a finer and finer subdivision of labor, and that the ultimate result, therefore, is to throw out the skilled worker and to replace him with the unskilled worker, thus preventing the development of mechanical ability.

Mr. TAYLOR. There is no question that, throughout all industry, there is a continual tendency toward the subdivision of work; but absolutely no greater under scientific management than under natural management. That is universal. You will find that in all trades everywhere. In any trade you will find this great subdivision going on.

Let me point out, however, this fact, which is not at all appreciated, that under scientific management we insist that every one of our workmen shall learn not one, but two or three or four trades. They have got to go up. Every man in our place goes up. We insist upon that.

It may be said that that is an assertion without proof, and I want to call your attention to the sworn statements before this House investigating committee. All of the men in an industry were there. There is a list of every man who started out, and ~~that~~ he was at this time. I refer to page 1502, third volume of the hearings before the House investigating committee, and that will show, as a result of this investigation there, that every man has gone up in wages and position, and that is so in every one of our companies. In our companies you will always find the same thing. We insist on our men going up. That is what we are there for—to keep them, to train them, and to let them see that we are their friends. Every man in the place knows that we propose to train him to do the finest and best class of work for which he is fitted sooner or later, and to bring him up.

Commissioner WEINSTEIN. You mean the purpose of the system is to bring out of the man the best there is in him, for his good and for the good of the employer?

Mr. TAYLOR. Yes; for their and our good. As we have said over and over again, our companies are mainly man factories, and secondarily something else. If we can first build up this high class set of men and train them and keep them to do good things, they will do the rest for us. There is no question about that.

Commissioner WEINSTEIN. Another point that has been made is this: That while it is admitted that the skilled worker under your system earns more than the skilled worker may have earned in the past, the fact remains that he becomes, after all, an unskilled worker when culled out of his particular job?

Mr. TAYLOR. Our men are the most sought after of any people in the country.

When a man leaves one of our establishments he can always get work, and they always come back to us when they get a chance.

Commissioner WEINSTEIN. They are all-round men?

Mr. TAYLOR. Certainly, because we have taught them, we have been kind to them—it is teaching, and not "nigger driving." It is a scheme genuinely to help the man along. They could not be our friends otherwise, and they are our friends.

Commissioner WEINSTEIN. One more point: A statement has been made that nothing could be more unfair than to put a premium on muscle, rather than on brain; and that a man should be paid not only for what he does, but also for what he knows; that this system puts a premium on their muscle rather than on their brains; that a man who can turn out, grind out the most stuff, is the man who is more highly paid, regardless of his brain power.

Mr. TAYLOR. I am looking for a particular man's name—C. Cox. He came to this country January 1, 1900, as a laborer at 15 cents. That fellow had an opportunity to serve an apprenticeship. He was intelligent, but not a very well educated laborer. He was a very intelligent fellow, and exceedingly industrious, and a fine chap. He first became rather a good man as a helper, and then was given a drill press, and taught drill-press work, and lathe work, and planer work, and finally he became foreman and head of the whole department. He came at 15 cents an hour, and when this was written he was making 40 cents an hour as a machinist. We had taught that fellow five or six trades. That is what we propose to do for every man.

The complaint has been made that raising these fellows up supplants our high-class mechanics; but these high-class mechanics become our teachers. Our factories are all managed by the workmen. They graduate from workmen and come to the management, and then cooperate with their fellow workmen up in a higher position.

Every one of them do that. When we raise them to a position at which we can not afford to pay them any higher wages, we send them forth as superintendents and foremen of other works.

Commissioner WEINSTEIN. You pointed out very clearly and strongly that the first essential to succeed under this scientific management system is to have the good will and hearty cooperation of the workers. I think you also spoke of the fact that in the beginning they looked upon this whole thing with suspicion.

Mr. TAYLOR. Surely.

Commissioner WEINSTEIN. They looked upon it as meaning a cutting down of their earnings and losing their jobs. If that is their attitude in the beginning, how can you win them over and secure their good will and cooperation? How do you overcome this suspicious feeling?

Mr. TAYLOR. Slightly by talking to them, but not much. Talk does not accomplish very much. Principally by building up an object lesson. We say to a man, "Come on and cooperate with us." One man comes on and cooperates with us, and we say to him, "It is a new thing and we will just try it and see if you do not like it." And we teach that man, and give him the 50 per cent higher wages, and let him work out that thing right along. And the next thing that happens is that his friends, two or three of them, will come and say, "I would like to have some of this. Am I not just as good as he is?" And we say, "Certainly. Come along." We never start in to change a factory over. We bring one man in and use him as an object lesson, and let him see what it is—whether it is an affair of "nigger driving" or whether there is anything bad about it. And these men see the other men getting these premiums, and they want them, too. They say, "He has got his; why can't I have mine?" The main complaint in our factories is not that we are introducing the system, but that, under this system, some of the fellows are not getting a show. They want to get in.

Commissioner WEINSTOCK. You mean that in the beginning they fight against it, and later they fight for it?

Mr. TAYLOR. In the beginning they fight against it, and in the end they fight for it; absolutely.

The CHAIRMAN. Mr. Thompson will you kindly ask your questions, or I think Mr. Garretson has some first.

Commissioner GARRETTSON. You spoke this morning of a condition where the foreman went in and increased the rate of pay, and he was hated before the directory and discharged for disturbing the labor market, by directors who were able to dominate the situation. What guaranty is there in your scientific system against precisely that condition taking place in a plant where the scientific system has been carried to its ultimate fullness, when change of management might take place, or change of control?

Mr. TAYLOR. There is absolutely no guaranty possible against any kind of inhumanity; you can not guarantee against that, but the man who did that would simply kill the goose that laid the golden egg; the moment he tries any such nonsense as that instantly his men would cease to be friends of his and the whole thing would tumble right down, and he would find his costs climbing right up, and the whole thing would tumble right away.

Commissioner GARRETTSON. That is what you meant; exactly the same thing would take place that had taken place before the piecework system; a man would be measured by his output under the bonus system, and would be expected to do that much under the straight wage system?

Mr. TAYLOR. Let me tell you: A man is not going to do it; it falls right down instantly. This is a question of friendship and cooperation. The American workman is not a slave; you take away his premium and away goes half of his output.

Commissioner GARRETTSON. He has gone back to the wage scale?

Mr. TAYLOR. And he has gone back to his original output; he is no worse than he was in the first place, and a darn fool comes in and thinks he can rob people. He can not.

Commissioner GARRETTSON. Has not the "darn fool" been universal in the wage problem, as far as that wage problem goes?

Mr. TAYLOR. As applied to the companies which we have systematized, I have not in mind one single company that ever got this thing in that went back on it; not one. I have never heard of one.

Commissioner GARRETTSON. Your system represents a fractional part of an inch in the measurement of centuries, does it not?

Mr. TAYLOR. Surely.

Commissioner GARRETTSON. Has not that type of man been prevalent in the wage system, the one you characterize as a "darn fool"? That is a very charitable name for him, but has he not been almost universal?

Mr. TAYLOR. No, sir; the great majority of this world are right; the great majority of the working people are right, and the great majority of the employers are right. If not, we would have a terrible world to live in. The great majority of people are right.

Commissioner GARRETTSON. Has justice been ordinarily maintained in the adjustment of wages?

Mr. TAYLOR. Nine hundred and ninety-nine out of a thousand; it is the thousandth case where it is not maintained. Justice is the universal thing in this world, almost; the injustice is the unusual thing. If it were not so this would be a horrible world to live in. We are tired of slavery. We are on toward democracy.

The CHAIRMAN. Now, Mr. Thompson, I want you to ask the regular questions. I want to say that I wanted to have Mr. Thompson first, but I made a mistake.

(Here the witness stated that the desired certain books, which were produced.) Mr. THOMPSON. These questions that I intended to ask you were not questions that would depend upon books, although I may touch on them in the questions that I shall ask.

In your address upon the subject of scientific management or efficiency systems, as we call them now, to-day, you said something about the establishment of measures in regard to doing the work, and I will ask you how and what kind of measures are established, whether the work is divided up into basics, day work, or how is it reached in your system generally?

Mr. TAYLOR. What kind of measurement or equitable task?

Mr. THOMPSON. No; as to a piece of work, as a task. What might it be in a specific case?

Mr. TAYLOR. Why, here they are all written out, fortunately. If you want to have an answer to that, here they are in writing, these tasks. Here they are, a lot of written tasks.

Mr. THOMPSON. Let me ask you further, and I will get at it, seeing that you have several methods. Do you use the element of time in arriving at a designation of a task; time measurement, for instance?

Mr. TAYLOR. Every elementary movement of every man has to have its appointed time, its proper time in which it ought to be done.

Mr. THOMPSON. When you say that every elementary movement of a man should be measured, you mean by that that you divide the operation or the task into more detailed parts, and for this part which you call an elementary movement you set a time method?

Mr. TAYLOR. Yes. We make a study of how long it would take to shovel a shovelful into a pile. We make 1,500 observations of a particular thing; we make 1,500 observations of one kind of material, by two or three good men—not poor men—and those are averaged out, and those furnish a foundation time. Then we always add a large percentage to that for unavoidable accidents and delays, and things of that sort.

Mr. THOMPSON. That becomes a foundation for that elementary movement, or code of laws?

Mr. TAYLOR. Yes.

Mr. THOMPSON. And you say that goes practically through all industries?

Mr. TAYLOR. Practically through all the industries.

Mr. THOMPSON. It might be called a basic or general law, perhaps?

Mr. TAYLOR. Those are the laws; the time laws of that industry.

Mr. THOMPSON. When you get to the measurement of the extra time, how do you do that; how is that arrived at?

Mr. TAYLOR. That is arrived at in many ways. For instance, you will have in your establishment a man who is recognized by his fellows as a good worker, a man who, when you stick to him and say "How long have you been at this job?" he says, "Ten or fifteen years." You ask, "Are you working as this job?" he says, "Ten or fifteen years." He says "Yes." You say "Very well, then; let think a man ought to work?" He says "Yes." You say "Very well, then; let you and me together examine this and see what you are doing. Let us get at this thing."

When you start in to study that man that way, you say "John, you want to go into this thing with us, don't you?" You know what we are after; do you want to go into it?" and he says "Yes," and you say "Very well. While you are doing this it will be an inconvenience to you, and it will be disagreeable, but we will pay you double wages. What we want is your regular standard pace that you find is right, that you agree is right and everybody else will. We study that man's motions, we find the exact time that it takes to do each elementary motion, and then we find that in addition to that, that it is necessary for him to have proper rest periods, and in order that he shall not be forced to work like a slave all the time, morning and night, and never shall be hurried, and that he shall have a certain amount measured for talking with his friends and whatever is right, he should do. There is a certain percentage added on that, never less than 20 per cent, and in some cases 100 to 120 per cent are added to the time in certain instances, but never less than 20 per cent on any job that I have had anything to do with.

Mr. THOMPSON. That extra time is allowed by some one; you need not state by whom.

Mr. TAYLOR. That is part of the laws; it is not allowed by some one else's say so, but it is part of the law.

Mr. THOMPSON. Will you please answer the question? If you haven't an opportunity of answering fully when you have answered the question, you will have an opportunity at the end. So that at first the time study is established by some one?

Mr. TAYLOR. Yes.

Mr. THOMPSON. And then the result of these observations and time studies is crystallized in a sort of law, and the time of the elementary operation, which is a general law, is next established beyond that for the extra time?

Mr. TAYLOR. Percentage allowances, as they are called.

Mr. THOMPSON. Now, there is a payment allotted, is there not, for the doing of this work to the workers?

Mr. TAYLOR. Yes.

Mr. THOMPSON. That is his reason for doing the work?

Mr. TAYLOR. One of his great reasons; yes; 33½ per cent.

Mr. THOMPSON. It is a basic law of his work; his compensation?

Mr. TAYLOR. Yes.
Mr. THOMPSON. I do not mean his extra compensation; what he originally gets for his work.

Mr. TAYLOR. Yes.
Mr. THOMPSON. Now, how is the amount of return that he is to get arrived at? First, you say he is to receive 83½ per cent, or whatever that may be, more than he received before. Who determines that what he got before is to be the basis for any computation of increase?

Mr. TAYLOR. Why, when a man, a laborer, comes to one of our establishments he applies to us, and we never take him at less than the working rate of wages there, and we almost always in our establishments say that no man can come to work as a laborer unless he gets a little more than the ruling rate of wages, whatever they may be.

Mr. THOMPSON. That is to say, when he comes to your establishment you say that he shall get the prevailing rate, and if he is working in the factory he gets that prevailing rate plus this additional percentage?

Mr. TAYLOR. Thirty-three and a third per cent. The moment he raises to a higher class of work in our establishments his wages go right up automatically and his base goes on and on and up, and added to the base is 83½ per cent, or up to 100 per cent added on top of that.

Mr. THOMPSON. Assuming that a man is working in one of these factories and your system has been tried out with reference to his particular work and you are ready to establish that rule, who determines whether he shall receive 83½ per cent increase or 100 per cent increase?

Mr. TAYLOR. It is determined entirely upon the character of the work in which he is engaged; it depends on the nature of the occupation.

Mr. THOMPSON. Who decides as to the character of work, determining the rate of percentage?

Mr. TAYLOR. That is done by a series of investigations, as I told you this morning.

Mr. THOMPSON. Who makes the decision?

Mr. TAYLOR. The investigator. No one can do it except the investigator. It is a scientific investigation, just as a man who figures there will be an eclipse of the moon and says it is so-and-so and writes it down; that is the man who determines it.

Mr. THOMPSON. So that you have in your system of efficiency, then, a scale of increases running from 83½ per cent up?

Mr. TAYLOR. Yes.

Mr. THOMPSON. The amount to be paid to the workman, whether it is 83½ per cent or more, is to be determined by an investigator working under certain determinations of his as to the basic rules or laws?

Mr. TAYLOR. Yes.

Mr. THOMPSON. Who hires the investigator?

Mr. TAYLOR. The employers, of course.

Mr. THOMPSON. Who pays the investigator for his work?

Mr. TAYLOR. The employers, naturally. You could not get the workmen to pay for the investigation. It would be unjust to ask them to do that.

Mr. THOMPSON. Who installs the use of your system in a factory or shop?

Mr. TAYLOR. Well, if they are wise they will get a man who has had experience.

Mr. THOMPSON. I do not mean the individual, but is it the owner of the business that installs the system?

Mr. TAYLOR. He gets an outside expert generally.

Mr. THOMPSON. But the owner does it or the proprietor of the business?

Mr. TAYLOR. Surely; yes.

Mr. THOMPSON. If the owner should decide that he did not want your system, it would not be put in—or any other system, any efficiency system?

Mr. TAYLOR. I do not know how you can in any way make a man do what he doesn't want to do.

The CHAIRMAN. Please answer yes or no, and make the answers as short as possible, Mr. Taylor.

Mr. THOMPSON. I also will endeavor to make my questions as short as possible.

Then, it is the owner or proprietor of a shop or a factory, looking over his work, that would decide whether he wants efficiency? He is the one that

would make the judgment, and he would determine as to whether it would be put in the factory or not?

Mr. TAYLOR. Yes.

Mr. THOMPSON. And he would determine what kind of a system he would want to put into use?

Mr. TAYLOR. Yes, perhaps.

Mr. THOMPSON. At least he would determine whom he wanted to consult with reference to a system to be established or put in use?

Mr. TAYLOR. Yes, sir.

Mr. THOMPSON. And either leave that to the judgment of some other man or men, or determine himself what system he wants?

Mr. TAYLOR. Yes.

Mr. THOMPSON. As I understand it, there are various systems of efficiency; is that so?

Mr. TAYLOR. Well, the word "efficiency" has been used in relation to about a thousand different things.

Mr. THOMPSON. Wait a minute—but generally speaking it is understood in regard to this field that you occupy that there is more than one entrant in the field, is there not?

Mr. TAYLOR. More than one person has taken the word "efficiency"; yes.

Mr. THOMPSON. I do not want to quarrel about the word "efficiency" but there are several people from whom a manager or owner of a shop might select as to which he would put into use?

Mr. TAYLOR. Yes.

Mr. THOMPSON. And the selection would rest with him or somebody that he might appoint to make the selection, would it not?

Mr. TAYLOR. Yes.

Mr. THOMPSON. Then, if he appointed a certain system—that is, for instance, he would have investigations made and time studies, etc., by the investigator or a set of investigators—it makes no difference which as to those from which he would make a determination as to the basic law that underlies the operation of a task and determine the wage or remuneration which would go to the worker, and the extent of it. Is that true or not? That is what you have already said.

Mr. TAYLOR. No; we would not make a new investigation; we would use the laws developed in 30 years for that investigation. We would make a brand-new investigation. These laws have been developed, and they are laws or facts.

Mr. THOMPSON. You would take either the result of other investigations which have been crystallized into laws or make new ones?

Mr. TAYLOR. Yes; we take the laws that have been developed in the last 30 years and we use those laws.

Mr. THOMPSON. Then as a matter of fact, it is the proprietor who would determine upon the introduction of the system, and through him either the laws already formed under your system or laws made from direct studies of his business would be put into operation, which would govern the workman at his task? That is true, is it not?

Mr. TAYLOR. If I understand your question, yes; I think it is. I do not know just what you mean. I can not look into your mind and see just what you mean by those words.

Mr. THOMPSON. As you understand them, that is correct?

Mr. TAYLOR. Yes.

Mr. THOMPSON. In your studies, or in the application of those laws, the individual workman would have no voice in so far as the selection of the system, or in so far as the selection of the investigators who should make the studies, if such investigations should be made, should use, would he?

Mr. TAYLOR. The individual workman, do you mean to say, in Mr. Smith's establishment?

Mr. THOMPSON. Yes.

Mr. TAYLOR. Mr. Smith would not consult his workmen as to what system was going to be introduced?

Mr. THOMPSON. Yes.

Mr. TAYLOR. I can not conceive of such a thing. I do not know, there might be such a thing. I can not understand it. It is to me utterly inconceivable. I have never known of such a system, where a man would start to introduce a system and never consult his own men. There might be such a crazy thing as that done, but I have never heard of it.

Mr. THOMPSON. Then, you would say that it would be a crazy thing for the proprietor to do, to introduce such a system as yours without consulting his men?

Mr. TAYLOR. Why, of course, I would. My gracious alive—

The CHAIRMAN. If that is so, there is no use arguing. Just say that that is the case, and let us save time.

Mr. THOMPSON. Now, when it comes to the determination of the amount of time needed in an elemental operation, you say this would be determined by an investigator. This investigator, you say, is selected by the proprietor or by people appointed by the proprietor, and that he makes these determinations. What voice has the employee in the selection of the investigator who is to determine finally the amount of time that is really required for this elemental operation?

Mr. TAYLOR. Are you assuming, now, Mr. Thompson—

Mr. THOMPSON. Please just answer the question.

Mr. TAYLOR. You are asking me a question that I can not answer. Your question is there, but I do not know what is in your mind.

Mr. THOMPSON. I will restate the question, then, because I do not want to have any doubt about it.

Mr. TAYLOR. I understood the question, but there may be a different meaning in your words, and we are not—

Mr. THOMPSON. Just answer the question as you understand it.

Mr. TAYLOR. Are you assuming that the investigator is going to work here and making a fresh investigation of this man's business? Is that in your mind; or are you assuming that he is going to use these laws or that slide rule that has been 26 years in being established under investigation?

The CHAIRMAN. Read the question to the witness.

(The reporter read the pending question as follows:)

Mr. THOMPSON. Now, when it comes to the determination of the amount of time needed in an elemental operation, you say this would be determined by an investigator. This investigator, you say, is selected by the proprietor or by people appointed by the proprietor, and that he makes these determinations. What voice has the employee in the selection of the investigator who is to determine finally the amount of time that is really required for this elemental operation?

Mr. TAYLOR. I want to know whether, in that elemental operation, you have in mind something that has never been determined before—that is, one out of perhaps one hundred things that go on in that establishment—or whether you have the ninety-nine that have been determined and are in this book and in that code of laws? Ninety-nine of those things are in the code of laws, and the hundredth remains to be determined.

Mr. THOMPSON. Of course, that deduction is perhaps arbitrary—that is, that ninety-nine have been determined and that the hundredth has not.

Mr. TAYLOR. I would say that more than ninety-nine have been determined in the art of cutting metals, in the art of machine-shop practice.

Mr. THOMPSON. You stated a short time ago that in the determination of the law which specified the time required for an elemental movement, you have had an investigator—sometimes more than one—appointed, who would make studies up to 1,500 perhaps—studies as to the time required. Now, in the selection of those investigators, if they are needed as an original proposition in any shop you go into, what voice has the employee in the selection of those investigators?

Mr. TAYLOR. Now, what do you mean by the "employee"? What do you mean by that? I do not know what you mean by the "employee."

Mr. THOMPSON. The workman who is being studied?

Mr. TAYLOR. The workman who is being studied?

Mr. THOMPSON. Yes.

Mr. TAYLOR. We always ask for his cooperation. In ninety-nine cases out of a hundred the man who is being studied has the matter put up to him, and we say, "This is what we are after. Do you wish to join us in this?" The man who makes that study is in ninety-nine cases out of a hundred a man who came from the workers, a man whom the workers in the shop have confidence in.

Mr. THOMPSON. I understand, but the workman has not the selection of the investigator, has he?

Mr. TAYLOR. Of the man who is going to investigate him?

Mr. THOMPSON. Yes.

Mr. TAYLOR. No.

Mr. THOMPSON. He has no selection. That is all I want, now. Now, if there were a difference of opinion between the worker, as to the time that it took to perform this elemental operation, and we will say the proprietor of the establishment, the determination of that time would be made by the investigator, would it not?

Mr. TAYLOR. As a preliminary, it would.

Mr. THOMPSON. Yes.

Mr. TAYLOR. But on the other hand—

Mr. THOMPSON. Now, just—

Mr. TAYLOR. Let me answer the question.

Mr. THOMPSON. You have answered the question.

Mr. TAYLOR. No; I can not answer the question, one-fourth of it, and let the rest of it go.

Mr. THOMPSON. I will give you an opportunity later to say what you want to. Mr. TAYLOR. But I can not leave that question one-fourth answered. It is not right to me to leave it in that way. Anything that you give to that workman has to be tried out to the satisfaction of the workmen in the shop.

Mr. THOMPSON. Yes.

Mr. TAYLOR. The first decision, as a preliminary, rests with the proprietor in the shop. I wanted to have that understood right off.

Mr. THOMPSON. Then the workman in the shop has the final say?

Mr. TAYLOR. Yes; it must suit him, and he must say that it is just. As a preliminary, you are quite right; the proprietor has everything to say about it, but the moment he touches it and the man comes out with that time table and he says, "There is your time," and he says, "I can not do it in that time," that must be settled to the satisfaction of the workman, and it does not require any appeal or any question. When any workman says, "I can not do it in that time; show me," he must be shown, and unless he is shown to his satisfaction, you have not scientific management.

Mr. THOMPSON. Yes; he is the final decider, in that he says that that time suits him. That is, he says that it is not too short. It may be too long, but if it is too short, he can say, "I will not do it."

Mr. TAYLOR. The code of laws contains a great many mistakes, but any time he says—

Mr. THOMPSON. I did not ask you about that. I want to get down to facts, and I want to make my own investigations, and if you want anything further you can put it into the record.

Mr. TAYLOR. Yes.

Mr. THOMPSON. Is it not the employee who is the final decider of the time he can take to perform an elemental operation?

Mr. TAYLOR. Yes; it is.

Mr. THOMPSON. Is it?

Mr. TAYLOR. Yes; he has the final determination. Mr. THOMPSON. Then, if you should go into a new establishment with the 99 laws already established in reference to that business in your book, an employee of that factory would have the right to turn those laws over and say to you and to your men and to the proprietor, "These are all wrong, and I will write new ones for you," and then state the laws as he understood, and the time-work as he understood, they should be applied to the elemental motions?

Mr. TAYLOR. No; he has the right to say, not that they are all wrong, but "This part of the laws is wrong." We will not listen to him if he says they are all wrong. Then we will make an investigation to see whether he is right or wrong, and we prove it in this way.

Mr. THOMPSON. All right, go on.

Mr. TAYLOR. The workman wants to know what he has and what he has not got.

Mr. THOMPSON. But who decides where the workman says to you, "This law is wrong"? Who decides whether or not it is right or wrong?

Mr. TAYLOR. I am trying to tell you, but if you do not let me talk, I can not tell you. If you will let me talk, I can tell you. The workman says, "This law is wrong."

Our answer to that is, "Very well, I am a workman myself. Take my stop watch and I will do this while you time me." He takes the watch and I do the work and he times me, and then I turn to him and I say, "Did I do it in the time?" He says, "Yes." Then I turn to him and say, "Now, you do it and I will hold the watch." Then the workman turns around and I time him while he

does it, and then we find that the workman is making false notions and is working in an inefficient way and we have a chance to see just what he is doing that is wrong. "You are holding your wrench wrong. If you will study this new and better way of doing this thing you will find you can do it in the time." We are teaching workmen in that way how to do what they are required to do in these operations.

Mr. THOMPSON. Suppose he finally holds his wrench right and it takes more time to do it, who decides whether he took the right time or whether you did? Mr. TAYLOR. This time has been established by experience in 50 establishments by men of a similar character; and we say, "We will pay your expenses, and you go to the shops and see other men do it."

Mr. THOMPSON. You have not answered my question. I asked you, and you know just what my language means—

Mr. TAYLOR. What is it?

Mr. THOMPSON. You tell that man that he has a wrong action; that he has not done it right; that he is "soldiering" on the time. In other words, you determine—I do not know what you tell a man—

Mr. TAYLOR. No; I do not say that he is "soldiering" at all. I say, "Very likely you are inefficient. You have not yet learned this right." Our men do not "soldier" after they come under this system.

Mr. THOMPSON. But you decide finally whether the workman's objection is well taken to your ruling, do you not?

Mr. TAYLOR. I do not. This code of laws decides it—this code of laws that has been proved to be right decides it.

Mr. THOMPSON. A code of laws is an inanimate thing and can not decide anything.

Mr. TAYLOR. There is nothing in the world more powerful than a code of laws. The whole United States is run by a code of laws. This code of laws that has been developed determines and we ask these men to go to these various shops and see whether it is right. That is our answer. The code of laws is above all people. That is what I want to impress.

Mr. THOMPSON. But the workman does not recognize that code of laws framed by Mr. Taylor and his associates in several shops as ruling human action.

Mr. TAYLOR. It is not framed by us.

Mr. THOMPSON. If you will just answer my questions, Mr. Taylor, we will save a lot of time.

Mr. TAYLOR. I am trying to answer the best I can.

Mr. THOMPSON. I think not. I am sorry to say that. If this workman goes to the other shops and comes back and says finally to you, "Well, I think that my position with reference to that law is correct," then what do you say?

Mr. TAYLOR. Then we have a very careful investigation made by one, two, or three men, whose judgment I have great confidence in, to go to those and other shops to see whether he is right or wrong.

Mr. THOMPSON. Then, suppose after you have made that investigation and have gone patiently and carefully over that with this man, this man still says to you, "In our judgment you are still wrong," then who decides the matter?

Mr. TAYLOR. I do not think I have ever had that case come up.

Mr. THOMPSON. But if it should come up? I am trying to get at all-sidedness of these matters.

Mr. TAYLOR. Finally justice decides it. Public opinion in the shop decides it. General public opinion of everyone.

Mr. THOMPSON. In whose person resides this capacity to determine exact justice? Does it reside in the workman? Is he able to say that this law is wrong? Or does the proprietor say? Or does the investigator, or investigators, sent into that shop to work out your system decide that question?

Mr. TAYLOR. A combination of all of them settle it. It is a democracy that decides it; a general democracy of the whole thing. It is public opinion of the shop that decides it. If a man continues to kick unjustly—a workman—public opinion of the shop frowns on it.

Mr. THOMPSON. You do not answer the question yet, Mr. Taylor, and I want you to answer it. Suppose that the employees on a given task who do that work in a shop, ten or a dozen men, should say to you that your law is wrong. Then suppose you should say to them, "Go to these other shops where it has been worked. And suppose they should go and should come back and still say to you, 'Mr. Taylor, you are wrong.'" Suppose, then, you should have special investigations made and new tables prepared, and they should still say to you that you are wrong, Mr. Taylor. Do you take what they say then? Do

you write their table? Do their tables become the incarnation of justice, or do you, or somebody for you, somebody representing your system, decide?

Mr. TAYLOR. Which one of those questions would you like me to answer? You have put an inquiry to me containing four or five questions, and I do not know which one of them you desire me to answer. You are asking me four or five questions at once, and I can not answer it until I know which one of them you want me to answer. If you will let me answer in my own way, I will do so; or if you will tell me which one of those questions you want me to answer, I will do my best to answer it.

Mr. THOMPSON. I am only asking you one question, and I will ask the reporter to read it now.

(The reporter repeated the pending question.)

Mr. TAYLOR. You have asked five questions in succession. Which one do you want me to answer? Or, if you will allow me to answer in my own way, I will answer. I want to know which one of those five questions you would like to have me answer.

Mr. THOMPSON. I will ask you: Did you not say a short time ago, when I asked you that if the individual workman disagreed with your table, then you asked him to go to other shops where the table was in operation to see how it worked?

Mr. TAYLOR. Yes.

Mr. THOMPSON. You said that?

Mr. TAYLOR. Yes.

Mr. THOMPSON. Then you did not say, in case he differed with that still, that then you made an investigation with reference to these specific laws, new investigations, and if they were still found to be correct, they were still enforced? Did you not say that?

Mr. TAYLOR. If I find those laws were right and being properly carried out and workmen were working under them in six or eight shops, all of them making good under them, and if I found that those workmen were not overworked, and they were normal workmen, well suited to their jobs, I would say, yes, these laws have been proved, and are correct.

Mr. THOMPSON. After you have done those two things suppose that the men still say that they think the laws laid down by you are not correct and are not the incarnation of justice, who decides it?

Mr. TAYLOR. I tell them that these laws are not laid down by me. These laws are embodied in this trade. These laws have proved themselves for the last 10 years. It is up to you now to show me that they are wrong. I will listen to what you have to say.

Mr. THOMPSON. Suppose they say "We believe they are wrong; we think they are wrong." Then what do you do? Who decides whether they shall work under those laws or not?

Mr. TAYLOR. If we find that in four or five shops many men are working under these laws to their satisfaction, I say there is something wrong with these workmen, then, and I try to persuade them. I tell them to get busy; to see what others have been doing under these laws. I ask them what is the matter with them, and I tell them what other people are doing and have been doing, and for them to climb up and get busy and do the same.

Mr. THOMPSON. But suppose you do not persuade them? Suppose they are still of the opinion that they are right? What is done, and who does it, then?

Mr. TAYLOR. To tell the truth, I do not remember ever to have had such a case as that in my life. I will climb that fence when I get there. I never run against that. Over and over again I have proved these things to men. I have sent them out to see other people who worked right. I have pointed out that this is so, and I have never met that kind of man. If I meet them, I will know how to deal with them. I can not take a supposititious case that does not exist. As far as I have found it, the mechanics that I have come in contact with and the workmen that I have come in contact with are endowed with a good deal of common sense and a good deal of judgment.

Mr. THOMPSON. Then, so far as I am able to gather, there is no final determining source in your system? Is that correct, Mr. Taylor?

Mr. TAYLOR. Except the gradual evolution of law. These laws are gradually evolved through the cooperation of both sides—not of one side. They build themselves up through the fact that they are giving satisfaction to both sides, and have to repeat it and repeat it and repeat it. That evolves the law. That is the way the common law of the world has been evolved, exactly in the same

way. The laws of this shop are so evolved, just as the common law governing all countries is evolved.

Mr. THOMPSON. I may tell you, Mr. Taylor, that the common law of this country and of England is evolved in many cases, and in most cases, from the judgments of courts and decisions by courts having the power to decide.

I am trying to find out from you a very simple thing. I am trying to find out, when you go into your shop and there is a difference of opinion as to the time taken, who determines it, and you do not seem to be inclined to answer that question. Anything that you would like to say on the subject I should be very pleased to hear.

Mr. TAYLOR. I have tried to make myself clear, that gradually a code of laws is evolved which is satisfactory to both sides, and that both sides submit themselves to those laws; that the manufacturer, the owner of a business, no more dares violate those laws than the workman does to violate those laws; that he refers to this code of laws not as to what he says—he does not say, "This is my judgment," but he refers to this slide rule, and he says, "There is 30 years of work. I stand on that. It is not a question for me to say. I do not recognize it or fail to recognize it. There is the scientific fact that has been developed. Those are the laws we are working under."

The CHAIRMAN. Let me see if the commission understands the situation. Your answer seems to amount to this, that you have not run across any case in your observation where there was a disagreement as to the length of time in which the task should be done. Is that correct, Mr. Taylor?

Mr. TAYLOR. No final disagreement.

The CHAIRMAN. Let us leave the subject, then, if the commission is satisfied to do so.

There is no objection. Proceed.

Mr. TAYLOR. I should welcome a tribunal, if one could be made, to which you could refer these things.

The CHAIRMAN. You say you would welcome such a tribunal?

Mr. TAYLOR. I would, indeed. I look forward to the day when the United States Government will furnish a tribunal of that sort. Nothing could be better in this world, to develop these laws and make them national laws.

The CHAIRMAN. There are one or two questions that have been evolved that I would like to ask you:

In attaining the increase in production of which you have spoken, to what extent would you say the results are due, divided into these subdivisions: The better planning of the work, the adoption of scientific standards; the utilization of new methods, and the elimination of "soldiering," as you have stated, on the part of the workmen?

Mr. TAYLOR. Of course, that would vary with the condition of the various types of business.

The CHAIRMAN. It would be impossible to make any general answer, upon that?

Mr. TAYLOR. No; but in a general way I should say that the immediate putting of the establishment in order—just plain common sense, the simplest kind of horse sense that any fool would have, almost, going into business; the putting it in order; just having things done the same way each time, instead of a new way each time.

The CHAIRMAN. Could you tell to what extent that figures?

Mr. TAYLOR. I was going to say that I have had it produce a 50 per cent increase, just that alone—putting things in order; a 50 per cent increase of output—moving things in the logical way throughout, seeing that they have no false movements, that things are not duplicated, that things are done in an orderly instead of a disorderly way.

The CHAIRMAN. That would include the better planning of the work, the adoption of standards, and the utilization of new methods? All of that would represent about 50 per cent?

Mr. TAYLOR. New methods is another matter.

The CHAIRMAN. Well, then, the other elements mentioned would represent an increase of 50 per cent?

Mr. TAYLOR. Merely the orderly movement of things, to stop disorder and have order in the place of it; that is, what we spend perhaps a year or year and a half on in any establishment.

The CHAIRMAN. And you say that in some places that has amounted to an increase of production of 50 per cent.

Mr. TAYLOR. Yes.

The CHAIRMAN. How much, or could you state how much of a percentage you have found of the increase of production would be due to the utilization of new methods?

Mr. TAYLOR. Methods new to that establishment?

The CHAIRMAN. That would be my idea.

Mr. TAYLOR. Methods new to that establishment, but old in other establishments. As a rule a very large part of the increase comes from that sort of thing; from the use of this slide rule, from the cutting out of a whole lot of foolish movements, movements that were entirely unnecessary, movements that a man is making because of the formation of bad habits, learned when he was young, perhaps; the gradual substitution, where it is a practicable thing, of the movements of the right and left hand at the same time—teaching the man to do something with both of his hands at the same time, instead of doing first this and then that [indicating]. That sort of thing would be perhaps the largest gain.

The CHAIRMAN. Could you estimate the percentage of gain in the same industry, or a typical industry such as you had in your mind when you said that the better planning of the work might result in a 50 per cent increase in production?

Mr. TAYLOR. I could not say that. I could have the matter looked up for you and try to approximate those various things in an establishment if you would like to have me do so.

If you would like to have me go back and look up the records I will do it, but it is hard to do it now. I have never put it exactly on that standpoint.

The CHAIRMAN. Very well, then. I will ask you this question, in the record, and you may give your answer. It will be sent to you:

In attaining to the large increases of production, to what extent are the results due to the better planning of the work, the adoption of standards, and the utilization of new methods, and how largely to the elimination of "soldiering" on the part of the workers?

That will be given to you so that you can analyze it, and if you can, why answer it.

What method, if any, has been adopted to determine whether or not the amount of work required of men is injurious to their health?

Mr. TAYLOR. As far as I know, the method is only that of closely observing the men when they are at their work. In addition to that, however, there are certain laws of fatigue which have been very carefully studied. When we begin in certain industries we can say absolutely certainly that this man will not be overworked, and can not be overworked, and in certain others we can say that they can be overworked. I will tell you by an illustration, if you like—

The CHAIRMAN. I would rather have you refer me to the laws.

Mr. TAYLOR. I will try to tell you what that law is.

The CHAIRMAN. Is it a written law?

Mr. TAYLOR. Yes; it is a written law.

The CHAIRMAN. Could you refer me, first, before you make your explanation, to any volume containing the law?

Mr. TAYLOR. Yes; it is somewhere in this book here.

The CHAIRMAN. It is in your work?

Mr. TAYLOR. Yes; it is here in this book. But I will repeat it very much quicker than I can find it.

If a man is doing very heavy laboring work, and has a load on the end of his arms, a push or a pull, or alternately a push and a pull, that is very heavy laboring; most of it comes on his arms, and if he has 45 pounds load on his arms, he must have a rest 58 per cent of the time. Even a big, powerful man must have that—the dry horseman must have 58 per cent rest.

If that load is reduced on each arm so that, instead of 45 pounds on each arm, it is reduced to 22½, he requires only 42 per cent rest. If that load is reduced to 15 pounds on each arm, he only requires 30 per cent rest.

That is a law carefully laid down, a law of fatigue. He must be free from load for his muscles to recuperate a certain portion of the time, as I have stated. That results from the study of the recuperation of the muscles. Not only that, but these periods of rest must come at quite frequent intervals. It will not do for him to have a load on his arm for four minutes at a time and then rest for four minutes. He must free himself from the 45-pound load oftener than every four minutes if he is going to get through properly with the 58 per cent rest.

The law of cooperation of muscles, and so forth, has been very well settled. I do not mean to say by that that there is not much to learn yet; there is still

a great deal to know, but we investigate overwork in that way, and when I say that men in a machine shop, 14 out of 15 can not be overworked, it is from investigation of the strains that they are under that they can not do it; the periods of rest are a necessity, and they are so frequent, and the stress on the arms and the body is so mild that we can not overwork them. I am saying this advisedly and not from any general talk about it, but from careful investigation. We made careful investigations to see how many men in a machine shop it was possible to overwork, and I find that not 1 in 14 is it possible to overwork.

The CHAIRMAN. Have you stated all the method which now comes to your mind which has been adopted to determine this factor of fatigue?

Mr. TAYLOR. No; there is another class of work. For instance, the young girl, the work of a young girl, who is particularly easily tired and quickly tired. We give her a job to do and then we study her very carefully to see when she shows any signs of nervousness. As soon as fatigue is beginning to show, and when she begins to fall off and wants to talk, we carefully study all that, and from that study we find that no young girl should go for more than an hour and a quarter without a complete rest, and so in our establishment, where we have our way and where we order them to do it, and they generally do it, and if they don't they have to quit, we give 10-minute rest periods every hour and a quarter, and every girl, when they leave the establishment, they go out and talk and get free, and then they come back again. These girls show nervous fatigue, and in that way we find that in eight hours a day it is very difficult to overwork a young girl, which is the one most sensitive and which we have to guard the best. I consider it very, very important that they should have these 10-minute rest periods at the end of every hour and a quarter. Perhaps we are wrong about the hour and a quarter.

The CHAIRMAN. But that is one of the methods you adopt?

Mr. TAYLOR. Yes. Perhaps it ought to be some other period, but that is what we have determined and what we believe to be best, and we find that it generally gives satisfaction to the employees; they are pleased with it. Some of them do not like to leave their work at the end of that time, but we make them. That is where we come in and we make them. We say, "This is the 10-minute rest period, and you can do anything but work in that period; you can go off and rest and talk to some one else, or please yourself in any way you want, but you can not do any work."

The CHAIRMAN. Do you think of any other method that has been adopted, to your knowledge, to ascertain this fact as to whether or not the amount of work required is injurious to health?

Mr. TAYLOR. Well, except to take the statistics of the men who have been working under it, that is all; we study the men. We take the length of time that they have been in the employ, and we see if they are happy, and we have them weighed once in a while to see whether they are going uphill or downhill. The CHAIRMAN. Is there a definite plan laid out in making that study in your code of laws?

Mr. TAYLOR. Nothing except what I have told you.

The CHAIRMAN. But the laws you mentioned—that is what I am trying to get at. Under your system is there a definite portion of the code devoted to this proposition as to weighing the men?

Mr. TAYLOR. Surely—no; not as to weighing the men; it is only when we suspect that they may be overworked in a line that we weigh them, and then not always, but only when we suspect that there is a possibility of overwork. But as a rule I find, as I have told you, there is a certain pressure pulling or pushing on the arms, and that is a pretty good safeguard for the men, provided you pick the right men; but if you get a light man and have him carry a load of 45 pounds on each arm, that is ridiculous; you will overwork him terrifically; so that we eliminate these men and take the men that are able to stand that.

The CHAIRMAN. That is just about the same as the large horse and the small one?

Mr. TAYLOR. Yes.

The CHAIRMAN. Does that result in lowering the quality of the output?

Mr. TAYLOR. Invariably the output is better. Our statistics show that everywhere we have observed we find that the output is better; we must have better output and we must have better quality. We must have more of it; and more of it without a better quality would be ridiculous; so that you will find, if you read what I have written on the matter, we always begin with quality;

we always begin by saying that a man may not lessen his work, but he is to do that first and give the same or better quality; and then you must never ask a man to do what he has not done before. We see that his quality is held up and that we must get better methods of quality rather than worse.

The CHAIRMAN. What is the result of the wages by employment under the scientific management?

Mr. TAYLOR. From 33 1/2 to 100 per cent better, at least. The report of this company shows that the men are getting 73 1/2 more—the average of them—73 1/2 per cent higher than they did when they came.

Commissioner O'CONNELL. What works was that?

Mr. TAYLOR. The Taber Manufacturing Co.

The CHAIRMAN. To what extent has that resulted, as regards compensation, with higher speed of production when there is such? Can you state that, or is that too broad?

Mr. TAYLOR. I can state it in a general way. I will state that we have never done anything but reduce; we always advocate giving the lowest hours at which a man can do his work; we have never increased the hours of labor, and it is always our tendency to go down; and, I might say, even in our machine shops, in which the output is dependent on the machine rather than on the men, we are seriously thinking of seeing whether it is possible to get down to eight hours in our shops, and away from nine hours, and still compete. You understand, if we can not compete the whole thing falls to pieces; we can not pay the big wages and we are injuring our men. In certain shops we are making a very great study to see if we can not reduce to eight hours and still maintain such conditions that we can pay the high wages; but we are doing no good to the man if you lower his wages at the same time.

The CHAIRMAN. Are there any statistics in existence showing whether the hours of labor have been reduced by the introduction of scientific management?

Mr. TAYLOR. Not that I know of; but I can assure you that they have been lowered; I have told you some.

The CHAIRMAN. I understand; but I just wanted to know if there was any such information. Now, kindly refer to page 69 of Shop Management.

Mr. TAYLOR. What volume?

The CHAIRMAN. I do not know.

Mr. TAYLOR. There are two editions here; that is the reason I asked that. I will see.

The CHAIRMAN. There is a quotation of this kind: "The writer has seen, however, several times after the introduction of this system the members of labor unions who were working under it leave the union in large number because they found that they could do better under the operation of the system than under the laws of the union."

Is that correctly quoted?

Mr. TAYLOR. Yes.

The CHAIRMAN. Kindly give me a specific instance—that is, the shops and the unions from which they retired.

Mr. TAYLOR. The Midvale Co. and the Bethlehem Steel Works, the Taber Manufacturing Co., and the Link Belt Co.—every company I have ever been in that has been so to a certain extent.

The CHAIRMAN. Mention all that you can remember.

Mr. TAYLOR. From my own personal knowledge, I can say that I believe there are a great many; but those are all the specific instances I have in mind.

The CHAIRMAN. Those are all the specific instances?

Mr. TAYLOR. Yes.

May I justify this and explain that a little further?

The CHAIRMAN. Certainly; make any explanation you like.

Mr. TAYLOR. I want to say this, that so far as I know no one who has ever had anything to do with scientific management has ever in the slightest degree discriminated against a union man or a nonunion man, so far as I know. I never heard of any discrimination one way or the other. The question is never asked, so far as I know, in our establishment, whether a man, when he comes to work, is a union or a nonunion man. We are trying to do for the workmen; we are after the same thing that the unions are trying to do for the workmen; we are after higher wages and we are after shorter hours, and we are after better working conditions. We are after exactly the same things that the unions are after. We can not have any quarrel with the unions; we agree with all these objects, and we have exactly the same objects. But this is an explanation. If a set of

workmen find that they are the best of friends with their employers they do not need to coerce them; and, mind you, I heartily agree with coercion that is necessary with the unions on behalf of the employers sometimes; I am a union man, and all I say is that under our system we have never had a necessity for coercion. We are anxious to do for our men, and we are doing and have done more than any union has done for them, but these men in the unions come to me and say sometimes, "Fred, I am tired of paying these dues. Would you leave the union?" I say that I have never advised them to leave the union or to join it. I say, "If it is better for you to belong to the union, go on; I have nothing to do with that matter." I do not say yes or no to unions in our shops. I do not object to the men belonging to them, but I tell them that they will have to judge for themselves. They say, "I am tired of paying dues when it is not doing anything for me" and they gradually leave; but they leave not in an unfriendly way to the union, and it is an extraordinary fact that has come up in connection with this, and it came up in my early youth, and I would like to tell this, which is to the point. My union friends are horrified that a man leaves the union.

In my youth my mother was a very strong antislavery woman; she was a friend of Lucretia Mott, William Lloyd Garrison, and Charles Sumner, and when I was a little boy I lived with antislavery people, and when Lincoln's proclamation came out I remember distinctly, young as I was, and I remember a great many of these antislavery happenings and their disappointment because it abolished their society. And so with the union people; they are sorry because we are doing more for their men than they, and are sorry we are treating them better and giving them shorter hours, and they feel sad that a man leaves the union for the same reason that these people felt bad because Lincoln issued his antislavery proclamation.

Commissioner WEINSTOCK. Their occupation was gone?

Mr. TAYLOR. Yes, sir; I can not help being amused at that analogy. I remember distinctly. I was only a young boy at the time; but these women had won their cause, and they felt darned sorry about it.

The CHAIRMAN. What provisions are made under scientific management for the proper training of apprentices?

Mr. TAYLOR. Exactly the same as elsewhere; that is to say, we take young fellows in and teach them as they do in any other shop. There is no difference at all; we simply take them and bring them up and teach them; and they receive a teaching that is away beyond any teaching you ever heard of before in your life. These teachers go out and stand at the machine with them, and they really teach them. They are not left to pick up a trade as I was; but these men are real teachers; these men are not bulldozers, but they are friends and they go to a fellow and say, "That isn't right." They say that to a young man or any man where he is inefficient with his machine; they say, "Let me show you," and they stand right there and show them; and if a man gets into difficulty he sends at once for one of these teachers to come and straighten him out, not as a bulldozer, as was the old efficiency idea of having a taskmaster, but as having a friend show him, and the teaching is immense. My boy learned in a year a better trade than I learned in two years, and he will be a better mechanic.

Commissioner O'CONNELL. You think an efficiency system if put into thorough operation would succeed the unions and they would go out of existence?

Mr. TAYLOR. No; I never look for the unions to go out. I am heartily in favor of combinations of men. I do not look for a great modification in the principles of unions as they now exist; they are of necessity largely now fighting organizations; I look for educational institutions, for mutual and helpful institutions; I look for great modifications, but never for the abolition of them. I simply look for a change, that the union shall conform itself to this new idea, the idea of a standard that is better for all of us, and a set of laws that will be over all sides.

TESTIMONY OF MR. JOHN F. TOBIN.

The CHAIRMAN. Mr. Thompson, you will kindly interrogate Mr. Tobin, please.

Mr. THOMPSON. Will you please give your name?

Mr. TOBIN. John F. Tobin.

Mr. THOMPSON. And your address and business?

Mr. TOBIN. President of the Boot and Shoe Workers' Union, 246 Summer Street, Boston.

Mr. THOMPSON. How long have you been in that business?

Mr. TOBIN. Since 1895.

Mr. THOMPSON. What are briefly, in a general way, the duties of that position?

Mr. TOBIN. General supervision of the organization, general supervision of our collective agreements, and the management of our union label and office correspondence.

Mr. THOMPSON. The boot and shoe workers represented in your union are mostly in large factories, are they not?

Mr. TOBIN. Large and small.

Mr. THOMPSON. Where machinery is in use?

Mr. TOBIN. Yes.

Mr. THOMPSON. And the product is generally made in parts, is it not?

Mr. TOBIN. In subdivisions, minute subdivisions, hundreds of subdivisions.

Mr. THOMPSON. Generally about how many subdivisions are there to a shoe, if you can say, of any one style?

Mr. TOBIN. Over a thousand.

Mr. THOMPSON. In regard to these operations there is great repetition on the part of the worker of the part of the job that he is doing, is there not?

Mr. TOBIN. The operations, many of them, are reduced to a fraction of a cent, and a small fraction of a cent, per part; in many cases a fraction of a cent per dozen pairs.

Mr. THOMPSON. No operator on a part of a shoe works on another part?

Mr. TOBIN. No, sir.

Mr. THOMPSON. In other words, he is a highly specialized worker?

Mr. TOBIN. Except it might be in the very smallest factories, he must be a specialist.

Mr. THOMPSON. In the factories in which your workers are located, Mr. Tobin, and where the work is divided into minute parts, wherever it be, have the workers had any experience with efficiency systems?

Mr. TOBIN. With what?

Mr. THOMPSON. So-called efficiency systems.

Mr. TOBIN. Not any of the recognized systems. Efficiency in the shoe trade was developed many years ago through the piecework system. The peculiarity of the shoe business is the high rate of speed at which all of the workers operate. With the possible exception of those very few in the factory who work by the day.

Mr. THOMPSON. What measures of efficiency are used in the highly specialized shoe factories, if you know?

Mr. TOBIN. I will give you my experience. I have not worked in a shoe factory for 25 years, but I worked with my watch constantly before me, and timed myself to a second on each operation, and worked with the view to producing more to-day than I produced yesterday, of my own initiative, expecting and believing that the more work I performed the more compensation I would receive. That is the incentive to all the operatives generally in the shoe trade.

Mr. THOMPSON. Is that true of the trade to-day?

Mr. TOBIN. More so than ever before.

Mr. THOMPSON. Then in the shoe trade the piece-price rule exists?

Mr. TOBIN. Almost exclusively.

Mr. THOMPSON. In the carrying out of that piece-price rule is there any instruction or education of the worker other than his own native ability would dictate?

Mr. TOBIN. There is no necessity for it. The incentive is there. The piece-work task is the incentive to high speed.

Mr. THOMPSON. Are you acquainted with the so-called efficiency system, of which Mr. Taylor represents one kind?

Mr. TOBIN. I have tried to study the efficiency systems, but I find the lack of efficiency in presenting them to be an obstacle to understanding them.

Mr. THOMPSON. Have you ever considered either Mr. Taylor's system or any other of the well-known efficiency systems, as they might be applied to the shoe industry?

Mr. TOBIN. I do not see how it would be possible to apply the Taylor system or any other efficiency system that I know of to the shoe business.

Mr. THOMPSON. Why would it be impossible, say, to apply the efficiency system, if you understand it, as you do, to the shoe industry?